

NIKOLA TESLA PAPERS

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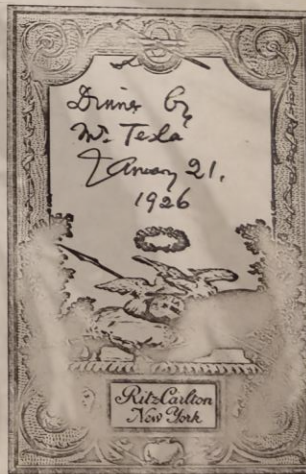
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COLUMBIA UNIVERSITY LIBRARIES
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Spec Ms Coll Tesla

Tesla, Nikola
New York, 21 Jan 1926
Cover menu of dinner
given by Tesla, signed by him
and by Agnes (Holden) Johnson,
Helen Hunt Johnson, Robert Underwood
Johnson, Petar Mestrovic and others.

Nikola Tesla
Agnes Holden
Flora Hilson (THF)
Frank H. Horn
Petar Mestrovic
Helen Hunt Johnson
Robert Underwood Johnson



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Spec Ms Coll Tesla

(Tesla, Nikola)
New York, 10 Jul 1937
p.d., 2 p. (Luncheon in honor of the
Yugoslavian Ambassador and the
Czechoslovakian Ambassador given by
Tesla on his 81st birthday -- Menu)

213802



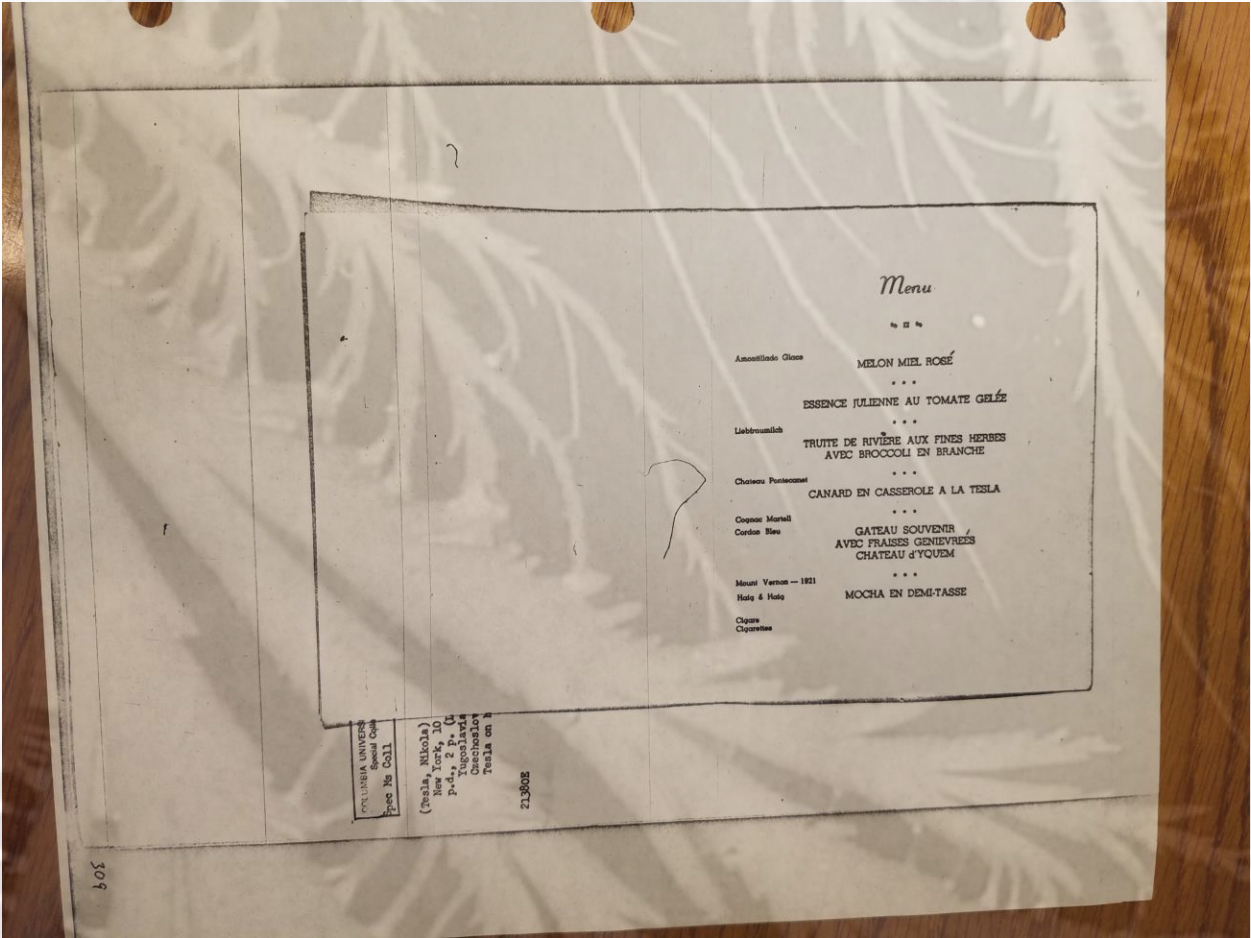
LUNCHEON
in honor of their Excellencies
CONSTANTIN M. FOTITCH
Ambassador of Yugoslavia
VLADIMIR HURBAN
Ambassador of Czechoslovakia
tendered by
DR. NIKOLA TESLA
on the occasion of his
EIGHTY-FIRST BIRTHDAY

HOTEL NEW YORKER, NEW YORK
SATURDAY JULY 10, 1937

COLUMBIA UNIVERSITY
Library
Spec No Coll 14

(Tesla, Nikola)
New York, 10 July
p. 4, 2 p. (Lunch
Yugoslavian
Czechoslovakia
Tesla on his

21302



Menu

Assortido de Ostras

MELON MIEL ROSÉ

...

ESSENCE JULIENNE AU TOMATE GELÉE

...

Liebrebrand

TRUITE DE RIVIÈRE AUX FINES HERBES
AVEC BROCCOLI EN BRANCHE

...

Chateau Pontac

CANARD EN CASSEROLE A LA TESLA

...

Copie de Muriel

GATEAU SOUVENIR
AVEC FRAISES GENEVRES
CHATEAU D'YQUEM

...

Muriel Varnon - 1921

MOCHA EN DEMI-TASSE

Hot & Cold

Copie de Muriel

COLUMBIA UNIVERSITY
Special Coll.
Box 18 Coll.

(Tesla, Nikola)
New York, 10
P.O. Box 10
Tugboat
Cachobato
Tesla on 1

21,308

COLUMBIA UNIVERSITY LIBRARIES
Special Collections
Spec Ms Coll Tesla

Tesla Machine Company
n.p., n.d.
t.d., 8 p. (bylaws)

213808

BY-LAWS

of the

TESLA MACHINE COMPANY.

: - 0 - :

ARTICLE I.

MEETING OF STOCKHOLDERS.

Sec. 1: The annual meeting of the stockholders of this Company shall be held at the office of the Corporation on the third Thursday in January of each and every year at 4 P.M. for the election of directors and such other business as may properly come before the meeting. Notice of the time, place and object of such meeting shall be given by publication thereof at least once in each week for two successive weeks immediately preceeding such meeting in the manner required by the Stock Corporation Law and by mailing at least six days previous to such meeting, postage prepaid, a copy of such notice, addressed to each stockholder at his P.O. address as same shall appear on the books of the Company. No business other than that stated in such notice shall be transacted at such meeting without the unanimous consent of all stockholders present thereat in person or by proxy.

Sec. 2: Special meetings of the stockholders other than those regulated by statute may be called at any time by a major-

ity of the directors. It shall also be the duty of the President to call such meeting when requested so to do by one director other than himself, and whenever requested in writing so to do by stockholders owning one-third of the capital stock. A notice of every special meeting, stating the time, place and object thereof, shall be given by mailing, postage prepaid, at least six days before such meeting, a copy of such notice addressed to each stockholder at his post office address as the same appears on the books of the Company.

Sec. 3: At all meetings of stockholders, there shall be present either in person or by proxy stockholders owning at least three-fifths of the capital stock of the Corporation in order to constitute a quorum except at special elections of directors pursuant to the General Corporation Law.

Sec. 4: At all annual meetings of stockholders the right of any stockholder to vote shall be governed and determined as prescribed in the General Corporation Law.

Sec. 5: If for any reason the annual meeting of the stockholders shall not be held as hereinbefore provided, such annual meeting shall be called and conducted as prescribed in the General Corporation Law.

Sec. 6: At all meetings of the stockholders only such persons shall be entitled to vote in person and by proxy who appear as stockholders on the transfer books of the Company for ten days immediately preceeding such meeting.

Sec. 7: At the annual meeting of stockholders the follow-

ing shall be the order of business, viz:

1. Calling the roll.
2. Proof of proper notice of meeting.
3. Report of President.
4. Report of Secretary.
5. Report of Treasurer.
6. Report of Committees.
7. Election of Directors and inspectors of election.
8. Miscellaneous business.

Sec. 8: At all meetings of stockholders all questions, except the question of an amendment to the By-Laws and the election of Directors and inspectors of election, and all such other questions, the manner of deciding which is specially regulated by statute, shall be determined by a majority vote of the stockholders present in person or by proxy; provided, however, that any qualified voter may demand a stock vote and in that case, such stock vote shall be taken immediately, and each stockholder present in person or by proxy shall be entitled to one vote for each share of stock owned by him. All voting shall be 'viva voce', except that a stock vote shall be by ballot, each of which shall state the name of the stockholder voting and the number of shares owned by him, and in addition, if such ballot be cast by a proxy, it shall also state the name of such proxy.

Sec. 9: At special meetings of stockholders the provisions of the General Corporation Law shall apply to the casting of all votes.

ARTICLE II.

DIRECTORS.

Sec. 1: The Directors of this Corporation shall be elected by ballot for the term of one year at the annual meeting of the stockholders, except as hereinafter otherwise provided for

filling vacancies. The directors shall be chosen by a plurality of the votes of the stockholders voting either in person or by proxy.

Sec. 2: Vacancies in the Board of Directors occurring during the year, shall be filled for the unexpired term by a majority vote of the remaining directors at any special meeting called for that purpose or at any regular meeting of the Board.

Sec. 3: In case the entire Board of directors shall die or resign, any stockholder may call a meeting in the same manner that the president may call such meeting, and Directors of the unexpired term may be elected at such special meeting in the manner provided for their election at annual meetings.

Sec. 4: The Board of Directors may adopt such rules for the regulation of their meetings and management of the affairs of the Corporation as they may deem proper, not inconsistent with the Laws of the State of New York or their by-laws.

Sec. 5: The Board of Directors shall meet at such regular times as they may fix and whenever called together by the President upon due notice given to each Director. On the written request of any Director, the Secretary shall call a special meeting of the Board.

Sec. 6: All Committees shall be appointed by the Board of Directors.

ARTICLE III.

OFFICERS.

Sec. 1: The Board of Directors immediately after the annual meeting shall choose one of their number by a majority vote

to be President and in the same manner they shall also elect a Vice President, a Treasurer, and a Secretary, and may also appoint such other officers as they may deem necessary. The elected Officers shall serve for one year or until the next annual election. The appointed Officers shall serve during the pleasure of the Board. The Board of Directors shall fix the salaries, if any, that shall be paid to the several Officers of the Company.

Sec. 2: The President shall preside at all meetings of the Board of Directors and shall act as temporary chairman at and call to order all meetings of the stockholders. He shall sign certificates of stock, sign and execute all contracts in the name of the Company when authorized so to do by the Board of Directors, appoint and discharge agents and employees subject to the approval of the Board of Directors, and he shall have the general management of the affairs of the Corporation and perform all the duties incidental to his office. At the annual meeting he shall present a written report to the stockholders, setting forth in full the condition of the Company. He shall countersign all notes or other evidences of indebtedness authorized by the Board of Directors.

Sec. 3: The Vice President shall in the absence or incapacity of the President perform the duties of that office.

Sec. 4: The Treasurer shall have the care and custody of all the funds and securities of the Corporation and deposit the same in the name of the Corporation in such banks as the Directors may elect. He shall sign certificates of stock and all checks, drafts, notes, and orders for the payment of money,

and he shall pay out the funds of the Company as authorized by the President or Board of Directors. He shall keep and have charge of the books of the Company, and at all reasonable times exhibit his books and accounts to any director or stockholder of the Company upon application at the office of the Company during business hours. He shall affix the seal of the Company to all certificates of stock and all other instruments requiring same when so directed by the Board of Directors.

Sec. 5: The Secretary shall keep the minutes of the Board of Directors and also the minutes of the meeting of the stockholders; he shall attend to the giving and serving of all notices of the Company; he shall have charge of such books and papers as the Board may direct; he shall attend to such correspondence as may be assigned to him; and perform all the duties incidental to his office.

ARTICLE IV.

CAPITAL STOCK.

Sec. 1: Subscriptions to the capital stock must be paid to the Treasurer at such time or times and in such installments as the Board of Directors may by resolution require. Any failure to pay an installment when required to be paid by the Board of Directors shall work a forfeiture of such shares of stock in arrears, pursuant to the Stock Corporation Law.

Sec. 2: Certificates of stock shall be numbered and registered in the order in which they are issued and shall be signed by the President or Vice President and by the Treasurer or Secretary, and the seal of the Corporation shall be affixed

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thereto. All certificates shall be bound in a book and shall be issued in consecutive order therefrom and in the margin thereof shall be entered the name of the person owning the shares therein represented, the number of shares and the date thereof. All certificates exchanged or returned to the Corporation shall be marked cancelled with the date of cancellation by the Treasurer and shall be immediately pasted in the certificate book opposite the memorandum of its issue.

Sec. 3: Transfers of stock shall only be made on the books of the Company by the holder in person or by power of attorney duly executed and acknowledged and filed with the Treasurer of the Corporation and on surrender of the certificate or certificates of such shares.

Sec. 4: Whenever the capital stock of the Company is increased, each bona fide owner of its stock shall be entitled to purchase, at the par value thereof, an amount of stock in proportion to the number of shares of stock he owns in the corporation at the time of such increase.

ARTICLE V.

DIVIDENDS.

Sec. 1: Dividends shall be declared and paid out of the surplus profits of the Corporation as often and at such times as the Board of Directors may determine.

ARTICLE VI.

INSPECTORS.

Sec. 1: Two inspectors of election shall be elected at each annual meeting of the stockholders to serve for one year,

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and if any inspector shall refuse to serve or shall not be present, the meeting may appoint an inspector in his place.

ARTICLE VII.

SEAL.

Sec. 1: The Seal of the Corporation shall be in the form of a circle and shall bear the name of the Corporation and the year of its incorporation.

ARTICLE VIII.

AMENDMENTS.

Sec. 1: These by-laws may be amended at any stockholders meeting by a vote of the stockholders owning a majority of the stock, represented either in person or by proxy, provided the proposed amendment is inserted in the notice of such meeting; they may also be amended at any meeting of the Board of Directors by a three-fifths vote of the Directors.

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Spec Ms Coll Tesla

Tesla Machine Company
New York, 27 Apr 1905
p.d.s., 2 p. (Stock certificate, one share, made out
to George Scherff)

21380E



INCORPORATED UNDER THE LAWS OF
NEW YORK

FULL PAID AND NON-ASSESSABLE

TESLA MACHINE COMPANY

CAPITAL STOCK, \$300,000

This is to Certify that George Scheff is the
owner of One Shares of the Capital Stock of
TESLA MACHINE COMPANY

transferable only in the books of the Company by the holder hereof in person or by
duly authorized Attorney upon surrender of this Certificate properly endorsed.

Witness the Seal of the Company and the signatures
of its duly authorized Officers affixed
this 27 day of April 1905

Langdon Spencer
Treasurer

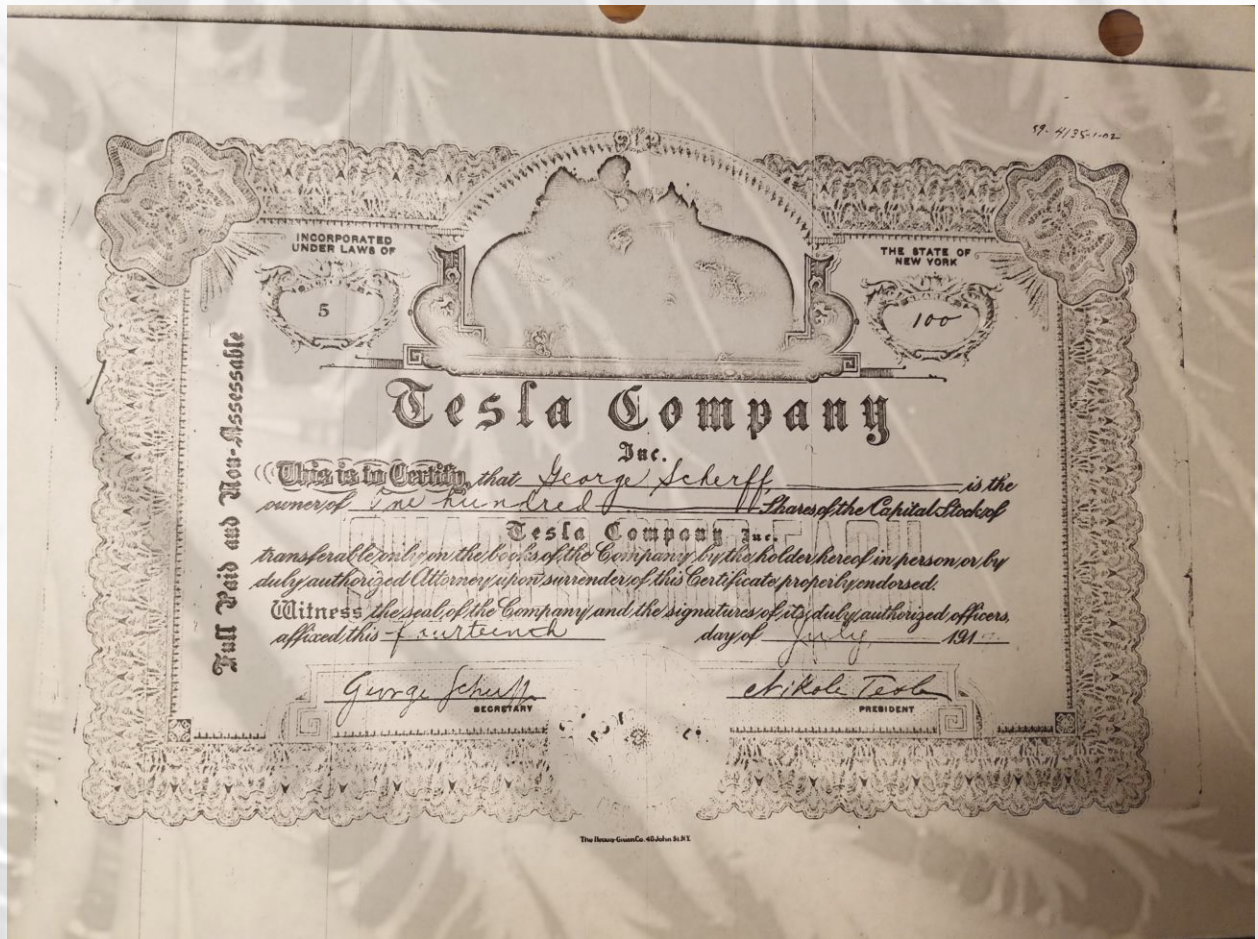
Wm. Andrews
President



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Special Collections
Spec Ms Coll Tesla

Tesla Company, Inc.
New York, 14 July 1917
p.d.s., 2 p. (Stock certificate, 100 shares
made out to George Scherff)

21380K



Full Paid and Non-Assessable

INCORPORATED
UNDER LAWS OF

5

THE STATE OF
NEW YORK

100

Tesla Company

Inc.

This is to Certify that George Scherff is the owner of one hundred shares of the Capital Stock of

Tesla Company Inc.

transferable only on the books of the Company by the holder hereof in person or by duly authorized attorney upon surrender of this Certificate properly endorsed.

Witness the seal of the Company and the signatures of its duly authorized officers affixed this fourteenth day of July 1911

George Scherff
SECRETARY

Nikola Tesla
PRESIDENT

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Spec Ms Coll Tesla

(Tesla, Nikola)
Miscellaneous magazine articles on
Tesla, or touching on him. (some passages are underlined by Tesla)

213803

7

Editorial Comment

Radio Waves and the Transmission of Electrical Energy for Power

Dr. E. F. W. ALEXANDERSON, consulting engineer of the General Electric Company and the Radio Corporation of America, in an address at the annual dinner of the Sigma Xi Society at the Hotel Astor in New York City, last April, predicted that the radio wave would soon be used for the control of vast amounts of power, and would supersede much of the cumbersome machinery now used in power production and transmission.

"The electric power industry cannot remain much longer untouched by the discoveries of radio," he said. "It is just waiting until this new knowledge has been widened and matured, so that it can be put into use on a wider scale, and this is the real significance of the entrance of the electrical industry into radio, and the latest branch of it, television."

Ten days after Dr. Alexander's startling prediction, electric lamps, held or suspended in the air without any connection to power wires, were made to glow brightly when high frequency waves were directed upon them in a demonstration of power transmission by radio by two Westinghouse engineers, Dr. Phillips Thomas and Dr. Harvey C. Rentschler, before the New York Electrical Society in New York City. Dr. Rentschler also displayed a novel radio furnace, in which metallic tungsten, among the most infusible of all metals, was heated white hot in an instant by the radio waves.

"We may visualize," said Dr. Thomas at this demonstration, "a parallel beam of radiation ten centimeters (four inches) across, along which is being sent ten kilowatts of energy. What sort of effects shall we find? Will this be the means for delivering energy for heat and light to individual houses? Dr. Nikola Tesla had a similar idea several years ago. Later improvements in the radio art make it interesting to consider such a possibility once more."

Guglielmo Marconi, inventor of the Marconi wireless system, while visiting this country last October, for the first time in several years, delivered an address on radio before a notable gathering of scientists at the Engineering Societies Building in New York City, in which he said:

"I hope I will not be thought too visionary if I say that it may be possible that some day electric waves may also be used for the transmission of power, should we succeed in perfecting devices for projecting the radiation in parallel beams in such a

manner as to minimize their dispersion and diffusion into space."

Dr. Nikola Tesla, one of the earliest pioneers in wireless, inventor of the alternating current system of power transmission, the induction motor, and many other notable electrical devices, the day before Marconi made the foregoing appeal "not to be thought too visionary," wrote a modest but direct statement of what he has already accomplished. Dr. Tesla said:

"The transmission of power without wires is not a theory or a mere possibility, as it appears to most people, but a fact demonstrated by me in experiments which have extended for years. The recent demonstrations of a number of experts with very short waves, have created the impression that power will be eventually transmitted by such means. In reality, experiments of this kind are the very denial of the possibility of economic transmission of energy. No concentration of energy such as I attain in my wireless power system can or will ever be achieved through the instrumentality of reflectors, for in transmitting energy in this manner the receiver can collect only an amount proportionate to the area exposed to the rays, while in my system it draws the energy from an immense reservoir in ever so much greater quantity. My plans for a power plant have been developed to the point of application, and I am using every effort to give to the world this, my best and most important work, as soon as possible. I have in view a number of places which seem well suited for the purpose, but my warmest wish is to transmit power from Niagara Falls, where the first triumph with my alternating system was achieved."

And meantime the entire world, with its vast resources of electrical energy in inland lakes, rivers and waterfalls, coal, wind, ocean waves and heat of the sun going to waste in billions of horsepower every day, waits patiently while radio scientists monkey with bulbs and reflectors to carry giant loads of chained lightning. It is about time some of them wake up to the fact that while they are shuffling around with little short-wave reflector sparks, Dr. Tesla has experimented with tremendous electrical power flashes, each more than one hundred and fifty feet in continuous length under perfect wireless control. Dr. Tesla has said so himself, his veracity is unquestioned, and his record of great accomplishments thus far backs him up. The "big business" end of the electrical industry ought to dig Dr. Tesla out of his laboratories long enough to say to him "Show me!" for there is enough money in it to suit even the wildest dreamers of Wall Street if he is right.

Telegraph and Telephone Age

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No. 23

DECEMBER 1, 1927

Forty-fifth year

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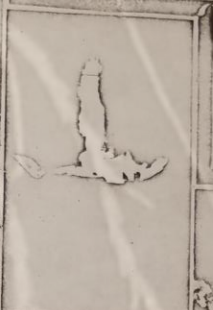
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• ROCKS Melt in Cold Furnace •

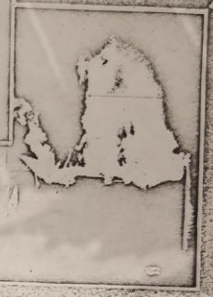
SIX THOUSAND degrees of temperature, Fahrenheit (3500° Centigrade) has lately been attained in an inductor (high-frequency) furnace, and even higher temperatures, it is predicted by engineers, may be attained through the application of the same principle. At the same



Electrical engineers testing a high-frequency furnace must beware of ultra-violet radiation.



The high-frequency coil of the furnace.



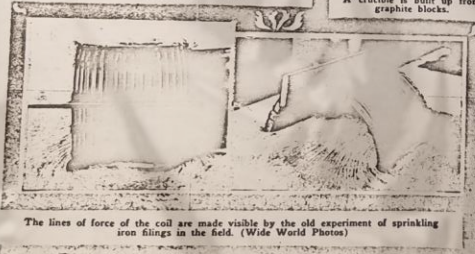
Heated fumes from a furnace still cold outside.



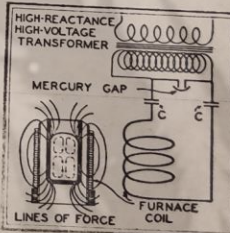
Checking over the assembly of a large-sized experimental high-frequency furnace.



A crucible is built up from graphite blocks.



The lines of force of the coil are made visible by the old experiment of sprinkling iron filings in the field. (Wide World Photos)



Schematic sectional view and electrical diagram.

• High-Frequency Furnace •

(Continued from page 322)

where the heat is applied from within, by the resistance to eddy currents (see diagram page 322) of a conductive material. A non-conductor is not melted in the field, because it does not resist its motion to the magnetic flux of the coil, and therefore does not acquire that high internal activity known as heat.

In the large experimental furnaces illustrated here, the temperature of the core has been increased nearly a thousand degrees Centigrade above previous figures; so that, within the crucible, graphite was vaporized. An advantage of this new design, developed by Frank T. Chestnut under the direction of Dr. Edwin Fitch Northrup of Princeton, inventor of the high-frequency furnace, is the practicability of maintaining the high temperature under control for a longer period.

The diagram illustrates the eddy-current principle of the high-frequency furnace, the coil outside, and the eddy currents circulating within the crucible; as well as the schematic diagram of a commercial furnace, in which the standard alternating current is raised to high frequency by the charge and discharge of condensers in series with the furnace inductance coil, and forming a resonant circuit, through a mercury gap.

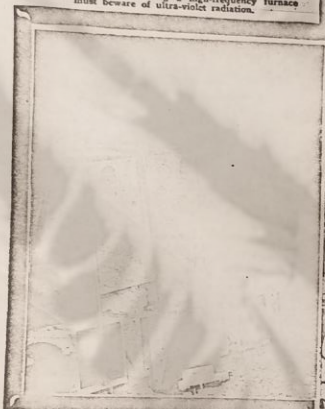
The basic idea of the inductor furnace, like practically all high-frequency current applications, was first conceived by Nikola Tesla, many years before its commercial ap-

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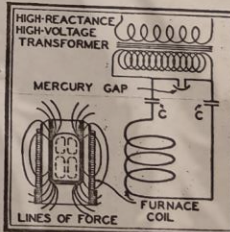
Heated furnace from a furnace still cold outside.

time, by the use around the crucible of a special form of lampblack, which has very high heat-resisting properties, it is possible to keep the outside of the furnace, only a few inches from the molten contents, quite cool.

This paradoxical effect is possible only in the high-frequency furnace. (Continued on page 322)



The lines of force of the coil are made visible by the old experiment of sprinkling iron filings in the field. (Wide World Photos)



Schematic sectional view and electrical diagram.

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(Continued from page 321)

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The basic idea of the inductor furnace, in which practically all high-frequency current applications was first conceived by Nikola Tesla, many years before his commercial ap-

• Odd Views of Some Old Acquaintances •

D ID you ever get a print from the photographer, and exclaim in dismay—"That's not in the least like me!" Well, most of us have shared the experience. Then, too, most of us have started out in our photography by making pictures which sent our friends into howls of laughter.

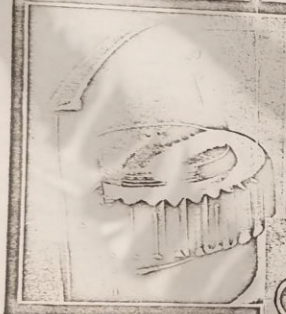


If this is not a caterpillar, what is it?

The merit of the trick photograph is in its ingenuity and the puzzling nature of its production. The reader should ask, at sight—"What?"—"How?" and add, when the mystery is explained—"Well!" (The curious may learn the real names of the objects pictured here, by turning to page 396.)

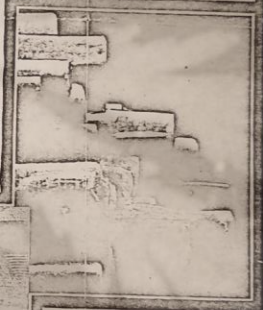


We are not discussing here the question of the inability of the subject to appreciate the truthfulness of the portrait, nor the errors of the inexperienced photographer—though some of the latter may be turned into money, if they are sufficiently amusing. What we do allude to are pictures of an odd, tricky nature with them. We will pay for photographs of this kind—this does not mean pictures of unusual subjects, but unusual pictures which may relate to familiar subjects—such as the very well-known specimens shown here.



• \$3.00 Each •

For each Trick Photograph sent in by our readers and published here, the oddity must be in the picture, not in the subject; and the print must be clear and sharp enough to make a good printing photo. You have your choice of methods, which are left to your ingenuity. Write your name and address on the photograph, and a brief explanation of the principle used; such as "double exposure," etc. Address: Trick Photo Editor, care this magazine.



Pictured in the upper left view, is an article which you have undoubtedly seen and handled often; if not, you are assuredly "far from the madding crowd." Below, a formidable piece of machinery, which is found in the household, as well as in duplicate in every railroad locomotive.

In the peculiar illumination of the upper picture, the conspicuous objects resemble well-preserved dinosaur eggs. They certainly cause disturbance when they hatch unexpectedly. Below, we do not have a pile of railroad ties; nor is the object at the left a modernistic vase. Then what?

• \$10.00 for the Best Idea •

EVERY month, **EVERYDAY SCIENCE AND MECHANICS** picks out from the hundreds of good ideas submitted **ONE OUTSTANDING IDEA**, which is published in this magazine. This idea is paid for at the rate of \$10.00 monthly. You all know that ideas "make this world go around," and make for progress. If you have a good idea, new and timely, be sure to send it in. The winner of the best will be paid \$10.00; while others accepted are paid for at the regular rates in this magazine.

It matters not in what line the idea is, it may be in science or mechanics, metal or woodworking, a simple labor-saving idea, or any other of thousands of ideas that are practical. Remember, the idea must be **PRACTICAL**, and it should be reasonably new.

This department closes on the first of each month. Address all contributions to Best Ideas Department, c/o **EVERYDAY SCIENCE AND MECHANICS**, 100 Park Place, New York City.

The prize for the current issue is awarded to **PAUL HADLEY** for "Buzz Saw from Old Sewing Machine," page 344.

under pieces as in Fig. 1, and in Fig. 2, are developments of the same form of decorative treatment that was used for the table top of Fig. 1; and, apart from the increase in size, and the shape of the contours, they are similarly made. The pieces of metal should be first cut to a plain oblong shape, and the outside then altered.



Nikola Tesla Receives Edison Medal

Notable Program at Annual Meeting of American Institute of Electrical Engineers—Interesting Insight into Mr. Tesla's Life and Work as Disclosed in His Address of Acceptance

Nikola Tesla, inventor and scientist, was presented the seventh annual Edison Medal at the annual meeting of the American Institute of Electrical Engineers held at New York City May 24. Announcement of this award was made in our issue of May 5. This notable event, with the memorable addresses made by A. E. E. Kennelly, Charles A. Terry, B. A. Behrend, and particularly by Mr. Tesla himself, formed the principal item of the evening's program, which also included the annual report of the Board of Directors and the announcement of letter ballot on the annual election of officers, which are reported elsewhere in this issue. After these business matters, had been disposed of, President Buck called on A. E. Kennelly, chairman of the Edison Medal Committee.

Dr. Kennelly gave an account of how the Edison Medal originated in a group of Mr. Edison's friends setting apart a fund in 1904 for the annual award to a living electrician of a medal for "meritorious achievement in electrical science and art." A deed of gift was drawn up designating the American Institute of Electrical Engineers to appoint from its officers and members a committee of six to determine the awards, six noted electrical men have been recipients of the Edison Medal, as follows: Elihu Thomson, Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush and Alexander Graham Bell. Dr. Kennelly stated that the medal award to Mr. Tesla was particularly for his development of the rotating magnetic field which is the fundamental principle that made possible the use of alternating current for operating motors, and also for his investigations of the phenomena of high-frequency currents.

MR. TERRY'S ADDRESS.

Charles A. Terry, who was associated with Mr. Tesla in some of his research work, then made an eloquent address on Mr. Tesla's electrical achievements. After dwelling on the unselfish creative impulse of the inventor, Mr. Terry said: "Twenty-nine years ago this month there was presented before this Institute a paper of unusual import. It was entitled 'A New System of Alternate-Current Motors and Transformers.' The author, Nikola Tesla, was then only 31 years of age, and but four years a resident of this country. His early life was spent near his birthplace not far from the Eastern Adriatic Coast. His father, a Greek clergyman, and his mother, herself of an inventive mind, secured for their young son a comprehensive training in mathematics, physics and philosophy. At the age of 22 he had completed his studies in engineering at the Polytechnic School in Gratz and also a course in the University of Prague; and in 1881 began his practical work at Budapest. In 1883 he was located at Strasburg, engaged in completing the lighting of a newly erected railway station. Shortly after finishing this task he came to the United States. Mr. Tesla's first work in this country was upon new designs of direct-current arc and incandescent lighting systems for the Edison Company.

"Throughout all these years his desire had been to find an opportunity to demonstrate the truth of a conviction which became fixed in his mind while studying direct-current motors

in school at Gratz in 1878; the conviction was that it should be possible to create a rotating magnetic field without the use of commutators. . . .

"By some fortunate process of reasoning he conceived, while in Budapest in 1882, that by using two or more out-of-phase alternating currents respectively passing through geometrically displaced coils it would be possible to develop his long sought progressively shifting magnetic field.

"Lack of funds and facilities for working out his theory compelled still further postponement, but in 1885 Tesla had the good fortune to interest men of means in a direct-current arc light which he had devised, and subsequently a laboratory was equipped for him in Liberty Street, New York, and here at last he found opportunity to demonstrate the correctness of his long cherished theory. In 1887 he was able to exhibit to his business associates and to Prof. William A. Anthony, whose expert opinion they sought, motors having such progressively shifting fields without the use of commutators, as he had foreseen nine years before.

"Having thus demonstrated the correctness of his theory and the feasibility of its application, it remained for Tesla to work out various practical methods of applying the principle, and the rapidity and wonderful way in which he surrounded the entire field of constant-speed synchronous, induction and split-phase motors is beautifully set forth in his paper of May 18, 1888, and in the numerous patents issued May 1, 1888, and succeeding years, covering the forms of electric motors which have since become the almost universal means for transforming the energy of alternating currents into mechanical energy. . . .

"Among the first to recognize the immense importance of Mr. Tesla's motors were Mr. Westinghouse and his advisors, Mr. Kerr, Mr. Bylesby, Mr. Shallenberger and Mr. Schmid, and in June Mr. Westinghouse secured an option which shortly resulted in the purchase of the patents, thus bringing under one ownership the alternating-current transformer system of distribution, and the Tesla motor. . . .

"The impress made upon the world by the deeds of a great inventor can not be measured by the number of patents which he has received nor by the monetary reward secured nor by the mere exploitation of his name. Often his greatest gifts are in the form of inspiring contributions to the literature, filled with suggestions of lines of thought which lead others to work in untried fields. This is especially true of a series of lectures delivered by Mr. Tesla upon the subject of high-frequency, high-potential currents. The first of the series was given at Columbia College in 1891, before this Institute. During 1892 and 1893 this lecture with additional data and experiments was repeated in London, Paris, Philadelphia and St. Louis. . . . During these lectures he exhibited to the audience numerous experiments displaying striking and instructive phenomena. He also described many novel pieces of apparatus, such, for instance, as his high-frequency generator and induction coils and his magnetically quenched arc. . . .

Mr. Terry quoted from many noted contemporaries of Mr. Tesla at that time their appreciation of the pioneer nature and



Nikola Tesla.

ADVERTS BY R. A. BERNARD

"Not since the appearance of Faraday's experimental researches in electricity has a great experimental truth been voiced so simply and so clearly as this description of Mr. Tesla's great discovery of the generation and utilization of polyphase alternating currents. He left nothing to be done for those who followed him. His paper contained the skeleton even of the mathematical theory."

Three years later, in 1891, there was given the first great demonstration by Swiss engineers, of the transmission of power at 30,000 volts from Lauffen to Frankfurt by means of Mr. Tesla's system. A few years later this was followed by the development of the Cataract Construction Company, under the presidency of our member, Edward A. Adams; and with the aid of the engineers of the Westinghouse Company. It is interesting to recall here tonight that in Lord Kelvin's report to Mr. Adams, Lord Kelvin recommended the use of direct current for the development of power at Niagara Falls and for its transmission to Buffalo.

"The due appreciation or even enumeration of the results of Mr. Tesla's invention is neither practicable nor desirable at this moment. There is a time for all things. Suffice it to say that, were we to seize and to eliminate from our industrial world the results of Mr. Tesla's work, the wheels of industry would cease to turn, our electric cars and trains would stop, our towns would be dark, our mills would be dead and idle. Yes, so far-reaching is this work that it has become the warp and woof of industry. * * *

PRESENTATION OF THE MEDAL

President H. W. Buck, in presenting the medal to Mr. Tesla, referred to the developments of some 30 years ago when direct currents were used almost exclusively and it remained for Mr. Tesla to make alternating currents available for miscellaneous purposes by his great conception of the rotating field. This made power transmission immediately practicable and permitted the development of the Niagara Falls enterprise and countless other power developments necessitating the use of polyphase currents. Mr. Buck also spoke of Tesla's pioneer work in high-voltage and high-frequency currents, which laid the foundation for such important later developments.

Mr. TESLA'S ADDRESS OF ACCEPTANCE

In accepting the Edison Medal, Mr. Tesla expressed his deep gratitude for the sympathy and appreciation shown him. He admitted that "a gigantic revolution has been wrought in the transmission and transformation of energy. While we are pleased with the results achieved," he said, "we are presiding on, inspired with the hope and conviction that this is just the beginning, a forerunner of further and still greater accomplishments." He then entered upon a fascinating account of some features of a personal and more intimate character bearing on his work, which lack of space unfortunately prevented discussion in full.

"In the first place, I come from a very wiry and long-lived race. Some of my ancestors have been centenarians, and one of them lived 129 years. I am determined to keep up the record, and believe there is a prospect of accomplishing it. Their nature has given me a vivid imagination which, through incessant exercise and training, through the study of scientific subjects, and the verification of theories through experiment has become very accurate in results, so that I have been able to dispense, to a large extent, with the slow labors, waste, and expensive processes of practical development of the ideas I conceive. It has made it possible for me to explore extended

May 26, 1917

"My life was also wonderful in another respect, for physical endurance or energy. If you inquire into the career of successful men in the inventor's profession, you will find, as a rule, that they are as remarkable for their physical as for their mental capacities. I know that when I worked with Edison, after all of his assistants had been exhausted, he said to me, 'I never saw such a thing, you take the cake.' That was the

characteristic way for Edison to express what I did. We worked from in the morning at half past ten until five o'clock the next morning. I carried this on for nine months without a single day's exception, but everybody else gave up. Edison stuck, but he occasionally dozed off on the table. * * *

"When I used my thoughts to inventions, I found that I could visualize my conceptions with the greatest facility. I did not need to make models or experiments, I could do it all in my mind, and I did construct many things. I consciously did it. I considered a new method in materializing inventive concepts and ideas, is exactly opposed to the method of the great inventor, which undoubtedly Edison is the greatest and best. He would not construct a thing in his mind, he would construct a device to carry into practice a crude idea. I found that what you will be engrossed with the details and effects of the apparatus. As you go on changing and constructing, you will lose sight of the great underlying principle, and you will lose sight of the sacrifice of quality. I did not construct. Where I had an idea, I started right away to build it up in my mind, and I changed the structure, I made improvements, I experimented with the structure in my mind. It is absolutely the same as you, whether I solve a problem or not."

shop gradually arising in my mind. It is of the kind of thing of which I have not in my mind any definite idea. It is not a definite idea, but it is a definite feeling. The results are the same. In this way you see I can develop an idea of a perfect an invention without touching anything, and when I have gone so far that I have put into that device every possible improvement I can think of, that I can see no fault in any more, I then construct it, and every time my device works as I conceived it would, my experiment comes out exactly as I plan it, and in twenty years there has not been a single, solitary experiment which did not come out exactly as I thought it would.

Mr. Tesla then related some very interesting experiences of his youth in which he had hairbreadth and almost miraculous escapes that led his parents to set him apart for the ministry. At the age of 18 during a violent epidemic of cholera he contracted the disease with several complications that made everyone despair of his recovery. "My father came to sit on my bed and said to me, 'Are you going to get well?'" he said to him, "I will get well if you will let me study engineering." He said, "Certainly I will, you will have to go to the best polytechnic school in Europe." My father kept his word, and after a year of roaming through the mountains and getting myself in good physical shape, I went to the Polytechnic School at Göttingen.

"The first year at the polytechnic school was passed in this way—I got up at three o'clock in the morning and worked until eleven o'clock at night, for one whole year, without a single day's exception. Well, you know when a man with a reasonably healthy brain works that way he must get something. Of course, I did. I graduated nine times in a row and some of the professors were not satisfied with giving me the highest distinction, because they said that did not express their idea of me, and here is where I come to the real field. In addition to the regular graduating papers I gave me some certificates. I got these certificates and showed them to my father. I thought it would be a great triumph. My father took the certificates and threw them into the

waste basket. He said, "Oh, I know how these certificates obtained." That almost killed my ambition, and my father died. I was mortified to find a pack of lies which I could see that there had been considerable distance going on between my father and the professor, and the professors had written to the effect he took me away from the school I would kill work. Then I understood why he had slighted which I was told was greater than any which achieved by any student before; in fact, the best only graduated twice, and I had graduated nine times in the first year had this result—that the professor was very much interested in me and very much to me.

[illegible]

"I will not tire you with an extended account of my undertaking, but I will say that my work was finished in 1877 in the summer, and then I would get a mind. I would picture, for instance, a direct-current and run it and see how these currents changed, and whatever I imagined, I would put together everything in my mind, and I continued that in 1882. I could not visualize just exactly how I felt I was approaching a solution. I was not sure enough the idea came to me. I will not

[illegible]

imparts energy to the disks. Such a turbine can operate at temperatures, is readily reversible and, extremely simple and free from liability of failure. With great ingenuity Tesla has constructed such machines of considerable power and interesting characteristics. It is to be regretted that real Tesla will soon succeed in the practical application of this invention. It is a relief survey even to touch upon many of his varied activities, but we must content ourselves with an inadequate presentation of typical genius of this man."

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moment. I was walking with a friend of mine in the city at Budapest, and I was reciting poems from Faust. Nothing for me to recite from memory the contents of the entire book, with every word between the covers, from the first to the last, and my sister and brother had a much better memory than mine. Just as the sun was setting I felt very inspired, and the idea came to me to write a book about the

every construction, every arrangement which I examined, was developed in my mind, except in three forms which appear in later developments. I had all the forms shown in the thirty or forty patents to me then in my mind. In 1882 I performed two experiments in Strasburg, as Mr. Terry pointed out, and there at the road station I obtained the first rotation.

"I have come now to an interesting point: when I came to America. I had made some improvements in dynamos for a French company who were getting their machinery from America. The improved forms were so much better that the manager of the works said to me, 'You must go to America, and you must design these machines for the French company.' So, after ineffectual efforts on the other side to get somebody to interest himself in my plans financially, I came to America."

"Then came another event. I met Edison, and the effect that Edison produced upon me was rather extraordinary. When I saw this wonderful man, who had had no training at all, no advantages, and did it all himself, and see the great results by virtue of his industry and application, I felt mortified that I had squandered my life—you see I had studied a dozen languages, I had dived in literature, and had spent the best years of my life in ruminating through libraries and reading all sorts of stuff that fell into my hands. I thought to myself, what a terrible thing it was to have wasted my life on those useless things, and if I had only come to America right then and there and devoted all of my brain power and intellectiveness to my work, what could I have not done? In later life I realized I might not have produced anything without the scientific training I got, and it is a question as to whether my theory as to my possible accomplishments was correct. In Edison's works we passed a year of the most strenuous labor, and then certain people approached me with a proposition to form my own company."

"Well, I went into the proposition, and we developed an arc light, and to show you how prejudiced the people were against the alternating current, as one of the speakers indicated, I told these friends of mine I had a great invention relating to alternating-current transmission, and they said: 'No, we want the arc lamp. We don't want this alternating-current system.' Finally I brought out an arc lamp, perfected it, and the city adopted it. Then I succeeded in organizing another company, in April, 1886, and then a laboratory was put up, and then I rapidly developed these matters, and finally the Westinghouse people approached us, and an arrangement was made, and then you know what happened since then. The invention has swept the world."

"Mr. Behrend has referred to other inventions of mine. I will say just a few words, because some of my work has been misunderstood. It seems to me that I ought to tell you a few words about other efforts that have absorbed my attention later. In 1894 I delivered a lecture at the Royal Institution and Lord Raleigh surprised me by acknowledging my work in very generous terms, something that is not customary, and among other things he stated that I had really an extraordinary gift for invention. Up to that time, I can assure you, I never realized that I was an inventor at all. I looked upon the rotating-field discovery as simply a mathematical deduction. It was a logical, step by step, deduction. I forced this invention, as it were, by screws and levers. I did not get an inspiration, as it were. My machines were developed all in my mind. When I tried the first experiments they meant nothing to me. I had already demonstrated them perfectly. So when I went home, in 1892, and heard these remarks of Lord Raleigh, I began to think and said to myself, 'Why, certainly I must have been an inventor.'"

"I remember that I constructed turbines and clocks and such things, and so I said to myself, 'If I really have a gift for invention, then I am going to bend it to some great purpose and some great task and not squander my efforts in small things.' I began to think just what was the greatest thing to accomplish. One day I was working in the forest and a storm came up. I ran under a tree for shelter, and the air was very heavy, and all at once there was a lightning flash, and immediately after the lightning flash a torrent of rain came. That gave me a fair start. I realized that the sun was lifting the water and vapor, and the wind swept it over the regions where it accumulated and reached the condition where at a

certain point it was condensed and fell to the earth again, and this life-sustaining stream of water was entirely dominated by some other power, and lightning or some other agency of this kind, simply came in as a trigger mechanism to relieve the energy at the proper moment. I started out and attacked the problem of constructing some kind of a machine which would this kind simply came in as a trigger mechanism to relieve the enable us to precipitate this water wherever desired."

THE COLORADO EXPERIMENTS

"That led me to the production of very intense electrical effects. At the same time my wireless work, which I had already begun, was exactly in that direction, and so I devoted myself to the perfection of some device, and in 1908, I filed an application describing an apparatus with which I think this wonder can be achieved. The Patent Office examiner was from Missouri, and he would not believe it could be done, and so my patent was never granted, but in Colorado I constructed apparatus by which I produced certain effects, at least, which were greater than those of lightning—I do not mean, for instance, in potential. The highest potential I reached was something like 20,000,000 volts, and that is insignificant as compared to lightning, but certain effects in my apparatus were greater than those produced by lightning. For instance, I got in my antenna currents of 1000 or 1100 amperes, and you know that in the biggest wireless plants only 250 amperes were used—I do not know what is the biggest one now—but 250 amperes is very large, and I know in Colorado I succeeded one day in precipitating a mist. Of course, there was a mist outside, but when I turned on the current the mist in the laboratory became so great that I called the attention of my assistant that when the hand was held just a few inches from the face it could not be seen, so that I am positive of my conviction that we are able to erect a plant of proper design in an arid region, and rules, and that we can draw from the ocean unlimited amounts of water for irrigation and power purposes. If I do not live to carry it out, somebody else will, but I am sure that I am right."

"As to the transmission of power through space, that is a matter which I have considered certain, absolutely certain, years ago. Years ago I was in a position to erect a plant to transmit wireless power to any distance without limitation, other than the physical limitations of the globe. In my system it makes no difference what the distance is. The efficiency of the transmission can be as high as 96 per cent, or 97 per cent, and there is no loss except those losses which are inevitable in the running of the machinery. And when there is no receiver there is no loss anywhere. When the receiver is put on, it draws energy. That is the opposite of the Hertz wave system. In that system you have a plant of 1000 horsepower, that is 1000 horsepower radiating all the time, but if I have a plant of 1000 horsepower under my system, this only consumes the few horsepower necessary to maintain the electric vibration, and the rest of the system is idle, exactly as the Edison lamps are idle when the lamps and dynamos are shut off."

"I have made advances along this line in later years which will contribute to the practical features of the system. Recently we have obtained a patent on a transmitter with which it is practicable to transfer unlimited amounts of energy to any distance. I had a very interesting experience with Mr. Stone, whom I consider, if not the ablest, certainly one of the ablest living experts. I said to Mr. Stone: 'Did you see my patent?' He replied: 'Yes, I saw it, but I thought you were crazy.' When I explained to Mr. Stone he said: 'Now, I see why that is great,' and he understood how this energy is transmitted."

"Now, gentlemen, we are coming to great results, but we must be prepared for a condition of paralysis for quite a while. We are facing an enormous crisis such as the world has never seen before, and until the situation clears the best thing we can do is to devise some scheme for overcoming the submarines, and that is what I am doing now."

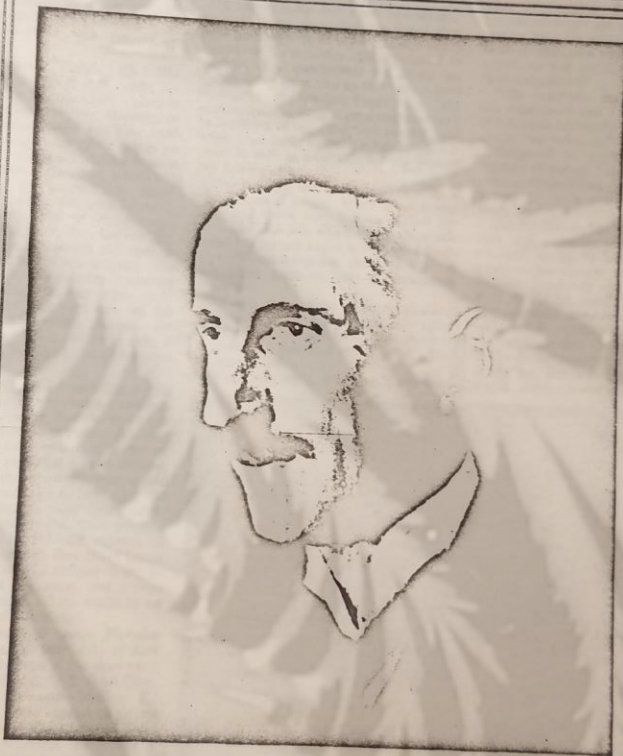
On other pages of the same volume is given Tesla's description of a new principle of fluid propulsion, which is the culmination of his labors of a number of years. As all generation of mechanical power involves the use of a fluid as the vehicle of energy, the foregoing idea is a broad one and bears on all the branches of mechanics.

Dr. Tesla avails himself of the two fundamental properties of a fluid, adhesion and viscosity, in an effort to produce a highly efficient mechanism. The fluid, whether receiving or imparting energy, is made to pass along the surfaces of a system of rotating disks in free natural spirals—that is, along paths of least resistance. The efficacy of the machines he has constructed on this principle is evidenced by their remarkable performance, small turbines or rotary engines being run at a peripheral speed actually more than half of that of reaction turbines, and giving several times the output of the latter. For example, a small steam turbine exhibited at the Edison station in New York, having a rotor only nine and three-quarters inches in diameter and two inches wide, was capable of developing 100 horsepower with free exhaust. This machine had no valves, valves or sliding contacts of any kind.

On account of the great simplicity of the apparatus, reversibility and extreme efficiency, it is readily found an immense variety of uses. The world can not fail to be deeply interested in this development. The electrical industry should be greatly benefited by the introduction of this principle.

TIME

The Weekly Newsmagazine



Keystone

Volume XVIII

NIKOLA TESLA*

All the world's his power house.
(See SCIENCE)

**From a portrait by Princess Luoff-Parlaghy.*

py 27

Number 3

SCIENCE

Tesla at 75

(See front cover)

On Nikola Tesla's birthday in mid-July, the electrical term which his name has become is regenerated as a tall, meagre, eagle-headed man. Reporters hunt him out of his hotel cubicle for his yearly interview and for a day his long-standing fame flares again. People who all their lives have lived by means of the devices he has invented and inspired, people who have forgotten there were an Alessandro Volta, an André Marie Ampère, a Georg Simon Ohm, a Charles Augustin de Coulomb, a Luigi Galvani or a James Watt, are reminded that there still is a Nikola Tesla (pronounced *Teshlah*) who long ago gave them the Tesla induction motor which made alternating current practical, and the Tesla transformer which steps up oscillating currents to high potentials (15,000,000 volts he avers, with 100,000,000 possible).

Last week was Dr. Tesla's 75th birthday. Interviewers wished they might see him as he used to be seen in his Colorado laboratory a generation ago, strolling or sitting like a calm Mephistopheles amid blazing, thundering cascades of sparks 30 ft. long, Tesla currents alternating at such prodigious frequency that they would not harm a kitten. But instead they found him, not without some difficulty, in seclusion on the 20th floor of Manhattan's Hotel Governor Clinton. Pale but healthy, thin to ghostliness but strong and alert as ever, he received his callers in quiet. His hair is slate grey, overhanging eyebrows almost black. His eyes are blue. Only their sparkle and the shrillness of his voice indicate his psychic tension. He wore an ordinary U. S. business suit, a white collar-attached shirt and a commonplace tie.

To Nikola Tesla, all the world's a power house. For 40 years he has been reasoning, calculating and arguing that the earth has a definite electrical resonance. All that men need do to have unlimited power at their command, and that power without the necessity of transmission wires, would be to generate electricity in tune with the earth's. The generators might be at waterfalls, coal mines, anywhere. Only possible drawbacks would be the vast expense of installation and the fact that every power house on earth would be obliged to generate the same kind of current, and anyone could tap the current. There could be no financial control of electricity.

Nonetheless the late John Pierpont Morgan believed in the possibility of such wireless power. That was at the time when Mr. Morgan was creating U. S. Steel Corp. and International Mercantile Marine. He was not averse to world control of power and communications. (The House of Morgan is banker for American Telephone & Telegraph, International Telephone & Telegraph, Western Union, United Corp., and many another electrical utility.) Banker Morgan gave Genius Tesla great amounts of money for experiment. In Colorado in 1899, Tesla built a huge induction coil by which he generated and, he says, sent out wireless waves the same

year Marconi established wireless communication between France and England. Tesla claims priority, because he conceived his system six years earlier, in 1893. The theoretical path of Tesla's waves were through the earth, not through the air as Hertzian waves go. On Long Island, Tesla built a steel tower 187 ft. high surmounted by a 68-ft. bossed dome. The tower was to disseminate wireless power. Mr. Morgan died in 1913. Dr. Tesla lacked money. He abandoned the tower, let it be destroyed in 1917.

Since then he has been pondering his theories. His annual interview has been a rehash of the same old subject—Broadcasted Power. But last week he made a "rare occasion" of his 75th birthday and talked about something new.

"I am working now upon two things," he said. "First, an explanation based upon pure mathematics of certain things which Professor Einstein has also attempted to explain. My conclusions in certain respects differ from and to that extent tend to disprove the Einstein Theory. . . . My explanations of natural phenomena are not so involved as his. They are simpler, and when I am ready to make a full announcement it will be seen that I have proved my conclusions."

"Secondly, I am working to develop a new source of power. When I say a new source, I mean that I have turned for power to a source which no previous scientist has turned, to the best of my knowledge. The conception, the idea when it first burst upon me was a tremendous shock."

"It will throw light on many puzzling phenomena of the cosmos, and may prove also of great industrial value, particularly in creating a new and virtually unlimited market for steel."

"I can only say at this time it will come

from an entirely new and unsuspected source, and will be for all practical purposes constant day and night, and at all times of the year. The apparatus for capturing the energy and transforming it will partake both of mechanical and electrical features, and will be of ideal simplicity."

"At first the cost may be found too high, but this obstacle eventually will be overcome. Moreover, the installment will be, so to speak, indestructible, and will continue to function for any length of time without additional expenditures."

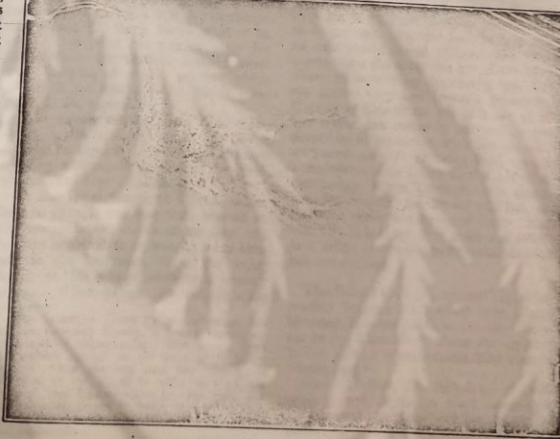
"Let me say that has nothing to do with releasing so-called atomic energy. There is no such energy in the sense usually meant. With my currents, using pressures as high as 15,000,000 volts, the highest ever used, I have split atoms—but no energy was released. I confess that before I made this experiment I was in some fear. I said to my assistants, 'I do not know what will happen. If the conclusions of certain scientists are right, the release of energy from the splitting of an atom may mean an explosion which would wreck our apparatus and perhaps kill someone. Is that understood?'"

"My assistants urged me to perform the experiment and I did so. I shattered atoms again and again. But no appreciable energy was released."

Badgered to reveal his own secret "source of energy," Genius Tesla politely evaded all questions, promised a definitive statement "in a few months, or a few years."

Yet he already has conceived "a means that will make it possible for man to transmit energy in large amounts, thousands of horsepower, from one planet to another, absolutely regardless of distance."

"I think that nothing can be more important than interplanetary communication. It will certainly come some day, and the certitude that there are other human beings in the universe, working, suffering, struggling, like ourselves, will produce a magic effect on mankind and will form



TESLA SPARKS & AUTHOR
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Managing Director

the foundation of a universal brotherhood that will last as long as humanity itself."

"When? "I have been leading a secluded life, one of continuous, concentrated thought and deep meditation. Naturally enough I have accumulated a great number of ideas. The question is whether my physical powers will be adequate to working them out and giving them to the world. . . ."

He received birthday greetings from Sir Oliver Lodge, Ernst Frederik Werner Alexanderson, Lee De Forest, John Hays Hammond Jr., Robert Andrews Millikan, Secretary of Commerce Robert Patterson Lamont, Henry Herman Westinghouse, and many another. Their greetings indicate the hope if not the confidence that "in a few months" or "a few years" the flame of Nikola Tesla's genius will weld one more astounding new device for mankind.

It is improbable that he will ever design such a device on paper, let alone in a machine shop, although before his mind's eye he may see it in every detail, motion, and defect. He is a great visualizer.

His first invention—before he was six and living at his native Smiljan, a Croatian village, in what is now Yugoslavia*—was something the like of which he had never actually seen. He pictured it curved, pointed at one end, fastened to a string at the other. The child modeled a piece of iron according to his vision and thus had the hook which he needed to catch frogs. Similarly he completely visualized his induction motor, his coils and transformers, all his inventions, before he sketched and constructed them. He has unlimited confidence in his visual inventiveness. He no longer bothers to build, seldom bothers to make notes. He simply reclines and cerebrates.

Years ago he had a laboratory in Houston Street, Manhattan. It burned down. He lacked money and desire to rebuild. He had an apartment in midtown Manhattan, in West 40th Street opposite the Public Library whose engineering room he still occasionally haunts, and near the Engineers Club which he no longer will visit. In that apartment he kept a few terrifying but harmless lightning machines. The swank St. Regis Hotel whither he moved two years ago was no place for such devices. Dr. Tesla contented himself with studying four pet pigeons which nested in his rolltop desk. Maids complained. He moved.

Many such stories about him exist. Once, while walking along icy Fifth Avenue he slipped, threw himself through a flying somersault, landed on his feet, unperturbed kept on walking.

At the Hotel Governor Clinton where he now lives, if someone rings him up on the telephone or knocks at his door and he does not want to answer, he locks himself in the bathroom, turns the water loudly on. He is very sensitive to sensory stimuli. When he gets excited, blinding

*His father, a Greek clergyman-orator; his mother, Georgina Mandic, a Serbian inventress of household thimemajors. "Her fingers were still nimble enough to tie three knots in an eyelash" when she was past 60. Dr. Tesla migrated to the U. S. in 1884 to work for Thomas Alva Edison, whom he soon quit. His naturalization papers he keeps in a safety box, his scientific medals and degrees in old trunks and cupboards.

lights flash through his mind. He retreats to bed. A lifelong bachelor, habitually he goes to bed at 5:30 a. m., rises at 10:30 a. m. But he does not sleep the whole period. Proudly, yet almost plaintively, he explains: "I roll around and work on my problems."

Sen for Ju

Unbelievable news came last week from the Kyoto University Observatory at Kyoto, Japan—the discovery of a new planet 11,000 miles in diameter and only 180,000,000 miles from the earth! No planet so large and near (the earth's diameter is 7,918 mi., its distance from the sun 92,900,000 mi.) could exist beyond modern astronomers' knowledge. They long ago would have spied it with their telescopes, if not with their unaided eyes. Or they would have calculated its existence, as the late Percival Lowell calculated the existence of the unseen planet Pluto (TIME, June 2, 1930) from the perturbations it caused in the orbits of the known planets. Questioning cables went to Japan.

Kaname Nakamura of the Kyoto observatory staff, when his agitation subsided, was able to trace a gross error. A reporter had misread the Japanese picture-word which described the new heavenly body. The symbol for ten, or *ju*, is approximately that of the mathematical plus sign (+); for 1,000, or *sen*, approximately that of the plus-or-minus sign (±). The careless reporter had added the upper cross bar. The new "planet" is a planetoid, about 110, not 11,000 miles in diameter. It lies between Mars and Jupiter in the general orbit of the thousand-odd other planetoids (TIME, March 24, 1930).

CINEMA

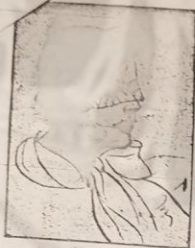
The New Pictures

A Woman of Experience (RKO-Pathé). Formula for spy stories: a shady lady enters government service in wartime and is assigned to make friends with an enemy spy. She also falls in love with an aristocratic naval officer. The crisis comes when she saves the life of the naval officer by outwitting the enemy spy. Few spy stories vary this formula greatly. *A Woman of Experience* varies it not at all. Spy stories are currently favored by producers as a measuring stick for actresses who seem capable of being built up into a resemblance to Greta Garbo (*Mysterious Lady*). Helen Twelvetrees is charming, low-voiced, auburn-haired, but she lacks the exotic numbness of Garbo, Marlene Dietrich *et al.* Her quiet and intelligent acting leaves the melodrama plausible but not exciting.

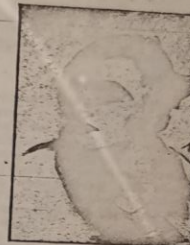
The Secret Call (Paramount) is mainly notable because its leading lady, Peggy Shannon, is being publicized as the successor to itty Clara Bow, whom she replaced in this picture when Actress Bow became "indisposed."

Stuart Walker, able technician of Indianapolis and Cincinnati stock companies, has handled the story well but shows his unfamiliarity with the cinema by not mov-

Liberty Mag., 1932



To the Ladies!



By

PRINCESS ALEXANDRA KROPOTKIN

linguist, friend of the famous in Europe, and descendant of the first czar of Russia

(Reading time: 4 minutes 45 seconds.)

OUT on the sidewalk on sunny days, in front of a commercial hotel near the Pennsylvania Station, you can see a gaunt old gentleman walking up and down. He is head and shoulders above the New York crowd. He is a giant.

Dr. Nikola Tesla is a giant in this town and time. During the greater part of this the greatest century in the inventive life of mankind, Dr. Tesla has worked and discovered and thought among the foremost.

He invented the arc light, developed the transmission of electric power without wires. He worked with Edison. His experiments in charging the human body with high-frequency currents (under certain specific conditions) have proved of inestimable value in medical practice.

"Some day," said Dr. Tesla, "we cleanse our bodies of dust and dirt."

As I talked with Tesla his thoughts swept back over the centuries to man's first awareness of electricity.

"Moses had an instrument for storing electricity," Tesla told me. "It came from the Egyptians, and it generated electricity from the friction of the wind blowing against curtains of silk."

We talked of Dr. Tesla's childhood; of his Serbian parents; of Smiljan—Place of Flowers—where he was born.

The vividness of his memory amazed me. Dr. Tesla remembers everything he ever has done or seen or heard throughout his long and eventful life. Incidents which occurred when he was two years old are as clear to him as those of yesterday, and he remembers word for word the text of books read in childhood.

Vision, a tremendous capacity for observation, intense interest in all the manifestations of creation—these are Dr. Tesla's, and with them a grave and courtly kindness.

AMONG the new books I like particularly Martha Ostenso's *Prologue to Love*. The rugged northern country of British Columbia interested me and the strength of the story is unusual, I thought. (Published by Dodd, Mead.)

SOME days ago a determined lady—she is socially prominent and very active in charity work—attempted to prove to me that everyone was much happier in the Middle Ages than most of us are today.

Since I talked with the determined lady I have come upon some rules that were in force at a rich English monastery of medieval times.

"A bath should by no means be refused to a body when compelled thereto by the needs of ill health. . . .

Should a brother wish for one when not advantageous, his desire is not to be gratified."

That was one of the rules. I wonder how the determined lady would like being compelled to forgo the bathing privileges of our kindly civilization? I wonder how she would like to wear the towering hair arrangement of the eighteenth century—and take her hair down only once a month?

Not for me! I prefer to live in 1932.

DO you remember the days when children were encouraged to collect flowers, ferns, and leaves, to press them and save them, and to pin them on sheets of thick paper with a neat description of each specimen written in a corner?

These childhood herbariums were beautiful and instructive. I had, I remember, a fine collection of dried seaweeds. Our trend today is all toward professionalism. Collecting leaves and plants is too often dismissed as leading nowhere.

Yet the road that seems to wander nowhere has a way, at times, of leading to some unexpected haven. For example:

Fifty women who learned how to preserve and classify plants when they were girls have just been given steady jobs at the New York Botanical Garden.

THE mole has burrowed its way back into favor. Moleskin is the fur of the year for our new "transformation" sets.

Wonderful things, these sets, and I am told that Scotch pelts are the best of the moleskins.

I saw one set consisting of a medium-sized moleskin collar with two fur scarf ends that could be attached to the collar or clipped on to a striped jersey scarf, and a small cape to be used with the collar or without. These combinations served in turn on two suits, two coats, and a cloth dress. I'll bet that set was made of Scotch mole. No other mole could inspire such thrift!

I MET a tall blonde at a recent tea party. I didn't hear her name. I judged her to be about thirty-five. "Mutton," said I to myself, "dressed as lamb."

A pancake hat perched on her curls—the way kids put their hats on sometimes when they are being funny. Her baby-blue dress clung too intimately to her figure, and she wore a large cheap-looking ornament at her throat—of imitation diamonds, I thought.

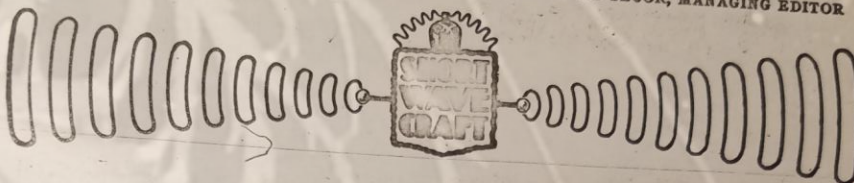
Half an hour later I learned her name. She was a much advertised beauty, a woman of great wealth. I realized that her diamonds were real but so ostentatious that they looked false.

And her actual age, I knew, was twenty-five, not thirty-five.

With just a little dignity and taste she would have looked a youthful twenty-five. Her foolish pursuit of schoolgirl "kiddishness" added ten years to her appearance.

HUGO GERNSBACK, EDITOR

H. WINFIELD SECOR, MANAGING EDITOR



Unknown Short Waves

An Editorial By HUGO GERNSBACK

● WE ARE apt to talk quite glibly about short waves—day in and day out. We use the instrumentality of short waves to receive music and talk from the Antipodes, and we use them for dozens of our other requirements, day in and day out; but, when it comes to the waves themselves, practically nothing is known about them! They are still a book sealed tight with seven seals.

So far, most of our experimental and research work has been concerned with the generation and the effect of short waves; but what happens to these waves between the transmitting antenna and your receiving set is still a deep mystery.

While we know in a general way that waves are reflected by the so-called Kennelly-Heaviside and Appleton layers, which gives rise to "skip effects," very little is known outside of this fact. We do know that the upper rarefied atmospheric strata reflect the radio waves, somewhat as a curved mirror would reflect light; still, this statement does not always hold true either, and other things are happening, most of which we do not understand as yet.

For instance, only recently, Signor Marconi on his yacht "Electra" did some constructive experimental work upon a 3/5-meter band. Normally, the effect of such a wave should not go beyond the horizon; because at these ultra-short wavelengths, as scientists think, the waves assume the physical characteristics of light, and therefore cannot go beyond the horizon, any more than a searchlight can go around the curve of the earth.

It is true that, as Marconi pointed out, light waves suffer a certain amount of refraction; so that you actually can see them a little below the horizon, but not much. This, however, does not explain how Marconi could send and receive short waves over a distance of 160 miles, when a light beam would not go more than fifty miles at the most.

We are, therefore, face to face with a new mystery of short waves; since they do not seem to behave "according to Hoyle." Something else happens here that we do not understand. The chances are that at this point our good friend Dr. Nikola Tesla steps into the breach. For many years, this illustrious savant, the most distinguished living inventor of today, has claimed that all radio transmission, whether on long or short waves, is not done by free waves in space at all, but that it is done by currents transmitted through the earth! Asked by me some years ago, how he explains transmission from an airplane to the ground,

Tesla stated that this is nothing but a condenser or capacity effect, wherein the ground was one plate and the plane another. This is not at all illogical, when it is considered that submarines can send and receive radio messages while totally submerged; always providing that their aerials are highly insulated and are not short-circuited by the salt water. The same is the case in exploration of the deepest caves that have, as yet, been reached by man. There is no trouble in signalling to these caves, and transmission and reception is always remarkably easy.

When Marconi, therefore, now transmits ultra short waves beyond the horizon, you may be sure that the ground effect, or the so-called ground-wave, has a lot to do with it; and future experimental and scientific research into this field will no doubt affirm or reject the theory.

There is still a tremendous amount of experimental work to be done in the exploration of radio waves. It has always been a source of wonder to me why short-wave experimenters have not tried their hand at "underground reception." This means of reception was first tried out on a large scale by the late Dr. James Harris Rogers of Hyattsville, Md. All during the war, by means of buried insulated cables, which rested in trenches anywhere from 3 to 6 feet below the surface of the earth, Dr. Rogers was able to receive regularly European stations, with an almost total absence of static. He could even receive such stations when a thunderstorm was raging overhead!

For those experimenters who reside in the country, I would suggest that they try their hand at underground reception for short waves. The trick is rather simple; all that is necessary is to bury a rubber-covered wire in the ground, after digging a trench some 20 to 50 feet in length, and then cover the cable. This then is your new aerial. It should even be possible, today, to use a transposition aerial with two feeder lines running in each direction, and bring the twisted cable into the set. This would do two things; it would no doubt improve reception, and it would certainly do away with a lot of natural static as well as "man-made" static.

Here is an extremely interesting field for the experimenter who wishes to accomplish something worthwhile and who wishes to leave the beaten track. The editors would be pleased to hear from those who have made experiments in short-wave underground reception, and the results will, of course, be published for the benefit of all.

SHORT WAVE CRAFT IS PUBLISHED ON THE 5th OF EVERY MONTH

This is the November, 1933, Issue—Vol. IV, No. 7. The next Issue Comes out November 5th

Editorial and Advertising Offices—96-98 Park Place, New York City

July 28, 1934

Scientist Describes True Folsom Points

Characteristics of These Interesting Relics of Ancient Americans
Outlined in Reply to Requests From LITERARY DIGEST Readers

The article "Stone Relics of Oldest Americans" which appeared in THE LITERARY DIGEST for June 9 attracted wide-spread attention and produced a flood of letters concerning the so-called Folsom points, man-made blades of chipped stone.

Many of the letters stated that the writers possessed similar specimens, and many sent samples or drawings. Examined by scientists of the Smithsonian Institution at Washington, less than 5 per cent. of these were found to be really representative of the Folsom type. Other correspondents expressed the opinion that there was nothing rare or different about such specimens; that they had been found by the hundreds on old Indian village sites in various parts of the country and had been pictured in many reports and publications.

Dr. Frank H. H. Roberts, Jr., archeologist of the Bureau of American Ethnology of the Smithsonian Institution, in response to a request by THE LITERARY DIGEST, explains the matter as follows:

A true Folsom specimen is a thin, leaf-shaped blade. The tip is slightly rounded and the broadest part of the blade, A-B in the diagram, tends to occur between the tip and a line across the center of the face. A typical feature is a longitudinal groove extending along each face, C, about two-thirds of the length, which produces lateral ridges paralleling the edges of the blade.

A cross-section of the object would give a bi-concave appearance as shown in the lower portion of the diagram. The base is concave, often with long, sharp, base points. There usually is a more or less fine marginal retouching, a secondary removal of small flakes, between the edges and the lateral ridge of the central groove.

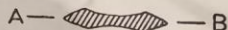
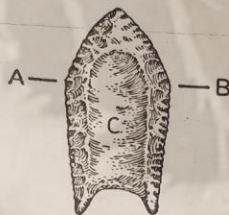
Another feature frequently observed is that of smoothed edges around the base and extending along the edges for about one-third the length of the blade. The usual material from which such objects were made was jasper, chert, or chalcedony. Some of the finest chipping of stone ever seen on New World specimens is to be found on the Folsom points.

All Features Are Present

The various features which characterize Folsom points may be found singly or in different combinations on specimens originating in several sections of the country, but unless all are present on each individual artifact it can not be considered an example of the type. Mere concavity of the base or a leaf-like shape does not constitute a Folsom point. These two elements are regarded by many as conclusive evidence that their specimens represent the type. Others rely entirely upon the presence of a longitudinal groove, even when occurring only on one face, and make their identification regardless of the shape or

size of the blade. Hence the belief that innumerable examples are to be found.

The points which became the pattern for the type were found near the small town of Folsom, New Mexico, in association with bones of an extinct species of



Lateral Ridges

Courtesy of Smithsonian Institution

Characteristics of a true Folsom point

bison. The men studying the problem agree that the points belong to an early phase of aboriginal American stone-chipping, and are anxious to determine its extent and distribution.

Why "Death-Rays" Do Not Work, Tho Many Are Invented

Four or five times a year some inventor announces that he has produced a secret "death-ray" which will kill whole armies at a distance, provide an invisible wall of force to protect a city or country, or short-circuit the electrical equipment of aircraft, motor-vehicles, or tanks miles away. Never do these inventors reveal the secret; usually neither inventor or ray ever is heard of again.

The case is different with the latest announcement along this line. The distinguished, elderly Dr. Nikola Tesla, who made it, is no "nut inventor." He is responsible for the induction-motor, the poly-phase electric current, and is a pioneer in the study of high-frequency transmission. Yet, having had several days to think the matter over, engineers and scientists are skeptical for the reason that this inventor, like the others, refuses to divulge the secret, and moreover admits that he has not yet produced the ray; merely has plans.

As a matter of fact, several kinds of lethal rays can be produced in the laboratory, but when it comes to projecting them any effective distance natural limits soon are reached. X-rays are deadly to

Heavy water, the oxide of deuterium, or heavy hydrogen, will be produced on a commercial scale at about \$1 a drop at the Pennsylvania State College, it was announced recently. It will be sold at cost to scientists.

Science Snap-shots

The new element No. 93, produced artificially a few weeks ago by the Italian physicist Enrico Fermi, may not be unknown in nature after all. Dr. O. Koblic has discovered an element much like it in pitchblende from the famous deposits in Czechoslovakia, whence came Mme. Curie's first radium-bearing ores.

Susceptibility to infantile paralysis may be due to lack of resistance which possibly is inherited. This is indicated in studies just completed by Dr. W. Lloyd Aycock, Director of Research of the Harvard Infantile Paralysis Commission. Twenty per cent. of the cases studied had a family history of the disease.

Two giant mosasaurs, thirty-five foot marine lizards which lived nearly 60,000,000 years ago in the Cretaceous Sea, are being excavated from a deposit of bentonite, a commercial clay used in making cosmetics, near Winnipeg, Canada. These creatures were unable to travel on land, had flippers instead of feet, and heads four feet long. The skeletons will be sent to the National Museum at Ottawa.

animals long subjected to massive doses, but unheard-of force would be required to send them any distance in such quantity. Gamma rays such as those given off by radium produce had burns and cancerous growths, but they really are too weak to have such an effect over a distance of more than a few centimeters.

Dr. Nikola Tesla If electrical bolts, such as lightning, are to be used, the object struck must be part of the circuit. If the ground is used to provide the return, how may the powerful bolt, supposing one strong enough could be generated, be prevented from following the shorter path and grounding itself en route?

There are many other possibilities, but every one canvassed by engineers has distinct limitations. It remains to be seen whether Doctor Tesla has something revolutionary enough to upset the known laws of physics. It is possible that he has.

Light on the Cuban Situation

Former President General Mario G. Menocal Stresses Short-Sighted Policy of Present Administration

PEOPLE in this country who chronically complain of the economic situation and sub-normal conditions of business do not seem to realize that, in actual fact, we are much better off than the rest of the world.

Cuba, as a case in point, near enough for Americans to study, is far worse off than we are. Due to a short-sighted and unresourceful government, Cuba has drifted into a serious economic crisis. Cuba had her chance in the latter part of the summer of last year, but lost it on the 11th of August at Pinar del Rio; although in the opinion of experts the soundest elements in the nation favored the return to power of former President General Mario G. Menocal.

General Menocal, during his administration, proved himself to be that admirable combination in a chief executive—a business man of a high order as well as a political leader, gifted with vision and judgment. Qualified observers are firmly of the opinion that he could have saved the past few years. The best minds of the country favored him and his policy and still do; but the reigning machine, apparently, is too strong to be broken as yet. Whether Cuba will be able to work herself out of her present difficulties, handicapped as she is, remains to be seen. It appears to persons in a position to speak with authority that she will not be able to do so. At any rate,

her return to comparative prosperity can be expedited only through a change of administration.

The short-sightedness characteristic of the present government manifested itself recently in its advocacy of a grant of a 40-year monopoly on the sale of oil and gasoline in Cuba in exchange for the payment of Cuba's national debt. General Menocal opposes such a scheme on the ground that it is unconstitutional and would be a bad business deal. His intimate knowledge of the resources of his country enables him to estimate the probable value to the government of the oil deposits for the next 40 years at \$300,000,000, whereas the national debt is only \$200,000,000. Thus the Cuban Congress is detected in the act of throwing away the huge sum of \$100,000,000 merely as a political move designed to appeal to the more shortsighted members of the body politic.

"No future government of Cuba would recognize such an agreement," General Menocal declared. "But would, doubtless, annul such a monopoly." The tax on gasoline, General Menocal said that Oscar Cintas, who is soon to be Cuban Ambassador to the United States, had been in Wall Street for several days trying to negotiate the oil monopoly agreement.

Such mis-steps as this would be avoided under an administration concerned with the true welfare of the nation and not solely with questions of political expediency.

Stimulus and Response

DR. NIKOLA TESLA, who contributed the basic inventions which made possible the commercial development of electricity, has hit upon another discovery which, we feel, will eventually benefit the human race in a manner comparable to the benefits derived from the mysterious fluid which so thoroughly permeates all centers of civilization these days.

This discovery, the details of which were only recently released to the press, is comprised in a simple experiment which shows the mechanical nature of the function of memory. Dr. Tesla, in demonstrating this experiment, arranged a number of tuning-forks at equal distances around a master fork. He then activated the master fork to the point where all the other forks responded to it. He selected one of the smaller forks at random, and taking it and the master fork into another room, he excited the master fork vigorously and for a long time, while the selected fork responded to it. He then returned with both forks to the first room and, placing the two back in their respective former positions, began gently exciting the master fork until only one fork responded—and this was the one he had chosen at random and treated to prolonged exposure to the vibratory waves of the master fork.

This experiment proves that the function of memory is mechanical and it opens avenues of investigation which seem to us to lead straight to the heart of the question of evolutionary processes in nature. The conditioning of an organism or of insensate atomic structures of any kind to repeated impressions obviously brings about some mys-

"Speak the Language Trippingly on the Tongue"

Try this on your ukulele: A bitter biting bittern bit a better biting bittern, and the bitten bittern bit the bitter bittern back, and the bitter bittern bitten by the better biting bittern is now a bitter biting bittern bitten back.—U. S. S. Breeze Kidder.

Tight-Wads

It's little use! New Jersey elected an "economy Legislature," and then the members voted themselves \$51 de luxe swivel chairs and \$24 card tables.—*Minneapolis Journal*.

terious change in that organism or structure which facilitates its absorption of repeated impressions of the same nature and renders it more susceptible to them. This law has long been recognized by physicists as it is borne out in the evolutionary processes among organic bodies, but only proves its existence in the former, but offers a readily accessible and demonstrable avenue for experimentation and research.

The human race owes Dr. Tesla a debt from which it will never be absolved, already; but we feel that the simple experiment which he has completed will result in immeasurably increasing that debt, and we hope that his keen intelligence is brought to bear on the continued investigation of the phenomena which it has opened up.

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THERE'S SOMETHING ABOUT THEM YOU'LL LIKE

Keep Up with the World



He died penniless when he might have made hundreds of millions

Nikola Tesla, a twenty-seven-year-old electrician from Austria-Hungary, arrived in New York in 1883 with less than a dollar in his pocket. Within three years, however, he had sold his new system of alternating current to Westinghouse for \$1,000,000 in cash. From then until his death in 1943, Tesla produced at least one other important electrical invention. Being a true scientist with little interest in financial affairs, he not only spent his money on laboratory experiments, but relinquished royalties did not make a profit on many of his ideas. Consequently, Tesla, one of America's greatest inventors, died penniless, whereas he might have left an estate of more than \$150,000,000.

trumpets which had belonged to Tutankhamen and had been found in his tomb when it was opened in 1922. As this Egyptian king died in the fourteenth century B.C., these trumpets are approximately 3,300 years old.

In many bazaars and market places in Asia and the Near East, the seller and prospective buyer of an expensive article on the price by "sawing" each other's fingers under a cloth. This keeps the amount of each sale a secret, a method which is imperative to a merchant who sells his goods by bargaining.

In the summer of 1883, a Boston newspaperman named Scamsey was looking for a good story and chanced to hear that earthquake tremors had recently been felt in the Indian Ocean. So he decided to concoct a fantastic tale about "a great volcanic eruption that had just occurred on the island of Krakatau." In writing the story, which he claimed had come from a secret source, Scamsey stated the explosion had blown away miles in the air and caused tidal waves which destroyed numerous coastal villages of Java and Sumatra, killing the inhabitants. The story was printed on the morning of August 28th in many U.S. and British newspapers which soon suspected the report was a hoax, as no confirmation of it had been received. But a week later, it was learned that a terrific eruption had taken place on Krakatau 24 hours before the publication of Scamsey's yarn and that his description of the catastrophe was substantially correct.

Two unique and weird sounds were featured on a radio program broadcast from the Museum of Antiquities in Cairo, Egypt, on the night of April 16, 1939. They were resounding blasts produced by the pair of bronze and silver

The three tiny bones in the middle ear, auditory ossicles, are the only bones in the human body that are fully grown at birth. On the other hand, the nose and ears are the only parts that normally continue to grow throughout life.

One of the strangest case histories of an American genius is that of William James Sidis, who spent most of his life in and around Boston and died at forty-six of an intracranial hemorrhage in 1944. While he was still an infant, his father, who was a psychopathologist, started out to make the boy a child prodigy. William developed so rapidly that, upon entering grammar school, he was able to finish the work of eight years in six months. At the age of eight, he had mastered mathematics and devised a new logarithmic table based on the number 12 instead of 10. When he was eleven, William entered Harvard where he astounded the faculty with a lecture on four-dimensional bodies and later graduated *summa cum laude*. In 1919, Sidis disappeared, having grown tired of thinking and of being publicized as a mental wizard. Five years later, he was discovered working as an adding machine operator, and from then until his death he would take only petty office jobs that, so far as known, paid less than \$25 a week.

Collier's for September 23, 1930

ITEMS

Nikola Tesla

A Prophet with Honor—Electricity's Great Radical

"Were we to eliminate from our industrial world the results of Mr. Tesla's work, the wheels of industry would cease to turn, our electric trains and cars would stop, our towns would be dark, our mills dead and idle. So far-reaching is this work that it has become the warp and woof of industry."

SO writes Dr. A. B. Behrend in his book on the induction motor—the motor which owes its existence to those studies of Dr. Tesla's which have proved to be of the greatest intrinsic value to the world of today. It would seem enough for any man, living or dead—and Dr. Tesla is very much alive—to put him down as a

principles; and Dr. Tesla, the individual, tall, spare, with a clean-cut, thin, refined face, and eyes of unbelievable keenness—the most charming of companions, well-read, well-informed on every question of the day and holding very definite opinions in regard to these questions, a wonderful conversationalist and a writer who handles words as



The flame-like discharge measures sixty-five feet across. Dr. Tesla produced this result by the discharge of an electrical oscillator giving twelve million volts. The electrical pressure, alternating one hundred thousand times per second, excites the normally inert nitrogen, causing it to combine with the oxygen.

benefactor of the human race. But in this case we have a four-fold personality: Dr. Tesla, the scientist and creator of electrical machinery; Dr. Tesla, the prophet, who goes probably further in definite prediction of what electricity can—and will—be made to do than any other man; Dr. Tesla, the radical, who holds views entirely at variance with many of the long accepted electrical prin-

Courtesy Oil Power & Standard Oil Company.

surely and accurately as though he were blending a chemical compound.

Nikola Tesla was born in 1857 at Smiljan, Lika, a borderland region of Austria-Hungary.

As the son of a minister, he had naturally been destined for the ministry, a life work which by no means appealed to him. He finally prevailed upon his reluctant parent to abandon this idea, and, since his preliminary schooling

SMITHSONIAN

was over, to send him to Gratz in Austria to finish his studies at the Polytechnic School with the object of becoming a professor of mathematics and physics.

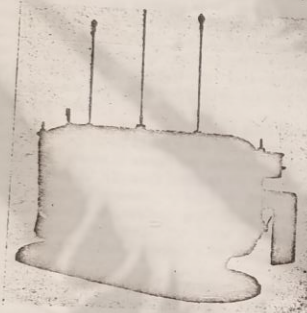
The idea of a professorship was abandoned, the next year, and Tesla turned his energies towards engineering. He worked in Hungary, in connection with the newly introduced telephone but soon realized that his connection held no future for him. He then pushed on to Paris and became an electrical engineer with one of the large companies in the new science of electric lighting.

As early as 1882 he concentrated on embodying the

ing magnetic field principle for alternating current work, and the application of it in those induction motors which have now become known the world over.

Mr. Tesla stood practically alone in his convictions on the subject of the alternating current. Few engineers had ever used it or were even familiar with its essential features. As a matter of fact, Tesla himself did not learn how to construct alternating current apparatus of even fair efficiency until after protracted efforts and experimentation. The proof of his success came in 1887-8 through the test of the distinguished expert, Professor Anthony of Cornell, when he demonstrated that Tesla's motors gave an efficiency equal to that of direct current motors. The final difficulty to be overcome in the construction of these motors was their adaptation to existing circuits, which were all built for direct current in this country. This was successfully accomplished. The Westinghouse people acquired these patents and produced the motor, applying to different needs.

The first paper given to the world on alternating currents was read by Mr. Tesla before the American Institute of Electrical Engineers in New York, in May, 1888, at the instigation of Thomas Comerford Martin and Professor Anthony. In connection with this paper, he exhibited motors that had been in operation long previous,



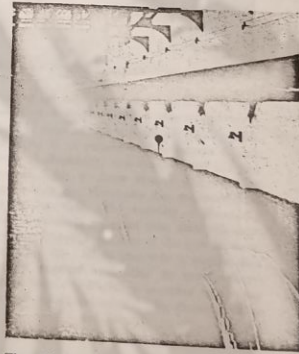
THE TESLA TELAUTOMATON

A crewless boat containing its own motive power, propelling and steering machinery, and numerous other accessories, all of which are controlled by transmitting from a distance, without wires, electrical oscillations to a circuit carried by the boat and adjusted to respond only to these oscillations.

rotating field principle in operative apparatus. Then and there he would have published his ideas, given them to the world, had it not been for the solicitations of his friends in commercial circles who urged him to form a company to exploit this invention—destined to have so profound an influence on the development of future electrical machinery.

Mr. Tesla met many Americans in France. From them he learned of the real encouragement given in the United States to any inventor who could attain some new and practical result. It was a bold undertaking, but he did not hesitate. Again burning all his ships behind him, he came to America to go to work the very day he arrived at the Edison Works—the goal of his ambition. It is easy to imagine the benefit and stimulus Tesla derived from association with Mr. Edison, for whom he always had—and still has—the strongest admiration.

In this congenial atmosphere his work soon attracted so much attention that he was asked to join a company formed to develop and sell an arc-lighting system based on some of his inventions. He brought this system to perfection and saw it placed on the market, but his thoughts were mostly concerned with his old discovery of the rotat-



The efficiency of modern generators, such as these at Niagara Falls, has been made possible because of Dr. Tesla inventions.

and with which his belief that brushes and commutators could be dispensed with, was triumphantly proved to be correct.

In 1890 Mr. Tesla left Westinghouse and devoted himself to experimenting with alternating currents of very high potentials and frequencies. Through his thirst to penetrate into the unknown, he was rewarded with results of the most astonishing nature, such as the transmission of electrical energy throughout the earth without any wire, the invention of an apparatus for electrical oscillators of tremendous power, and the transmission of electrical en-

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ergy to any distance without wires. These things he mentions in an article which appeared in the *Century* for June, 1900, entitled "The Problem of Increasing Human Energy"—an article that proves Tesla to be one of the deepest thinkers of our time. These results he also set forth in a lecture in May, 1891, which may be said to have marked a distinct departure in electrical theory and practice.

May 18, 1917, Dr. Tesla was presented with the Edison Medal by the American Institute of Electrical Engineers in the auditorium of the United Engineering Societies Building, in New York City. This medal is awarded annually for "meritorious achievement in electrical science, electrical engineering or the electrical arts" by a committee of twenty-four members of the American Institute of Electrical Engineers.

It might be said of Dr. Tesla that he is a fundamentalist in electricity, digs down to the roots and essences of his chosen subject, refuses to accept any conclusion without the closest scrutiny. Certainly some of his views on electricity are radical. For example, he flatly denies the existence of the electron as popularly pictured by science. He claims that it has never been isolated and thinks that some of the investigators have mistaken a hydrogen molecule for an electron.

Perhaps his most outstanding disagreement with generally accepted theories has to do with Hertz waves. Dr. Tesla claims that radio transmitters, as now used, do not emit Hertz waves as commonly believed, but *waves of sound*. He bases this belief on the fact that as early as 1897 he demonstrated that the ether is a gas which can transmit only waves of sound, that is—such waves as are alternately propagated by alternate compressions and rarefactions of the medium in which transverse waves are absolutely impossible. He claims that Dr. Hertz, in his celebrated experiments, mistook sound waves for transverse waves and that this illusion has been constantly kept up by his followers and has greatly retarded the development of the wireless art. As soon as experts become convinced of this fact they will find a suitable explanation of all the puzzling phenomena of the so-called radio.

Again, Dr. Tesla does not believe in the popular idea of deriving motive power from the disintegration of atoms or change of elements. He holds that radio-activity is due, not to forces in the substances themselves, but to a cosmic ray, the discovery of which he announced in 1897. In simple language, an element like radium emits radiations merely because the cosmic ray impinges upon it, thus producing these secondary effects.

He believes that television inventors are on the wrong track and that television in the future will have all the complicated parts located in the transmitting or central station and that the receiver of the picture will have practically nothing but a screen, together with a wave, or station selector.

The amazing thing about Dr. Tesla is that he seems to have always been, and still is, ahead of his time. For example: the principle of neon lamps, as they are now used, was discovered by Dr. Tesla thirty years ago, and he even had in operation at that time filamentless, gas-

filled electric lamps standardized to 50 candle-power. He predicts that the day of the filament lamp is over and it will be replaced by the light from properly gas filled tubes, which will be more economical, infinitely more lovely, and last forever.

Nikola Tesla's induction motor, high voltage trans-



Illustrating the capacity of the oscillator for creating a great electrical movement.

The ball is covered with a polished metallic coating of 20 sq. ft. of surface, and represents a large reservoir of electricity, and the inverted tin pan underneath, with a sharp rim, a big opening through which the electricity can escape before filling the reservoir. The quantity of electricity set in movement is so great that, although most of it escapes through the rim of the pan or opening provided, the ball or reservoir is nevertheless alternately emptied and filled to overflowing—evidenced from the discharge escaping on the top of the ball—one hundred and fifty thousand times per second.

former, and system of alternating current transmission have brought him fame and fortune. Among his inventions which are little known to the public are a radical new apparatus for the wireless transmission of power, bladeless turbines, aeroplanes that rise and descend vertically and the Tesla viscosity speedometer which registers the speed in miles per hour. This speedometer is based on the fact that when one disc is driven by a flexible shaft from the engine transmission the drag of the air particles between the revolving disc and a closely positioned second disc is such that the latter will be turned through part of a circle proportional to the speed of the driven disc. It is only necessary, therefore, to calibrate the second disc in revolutions per minute or miles per hour, to have a perfect speed indicator.

But it is Dr. Tesla, the prophet, who makes us catch our breath in awe—since he is a prophet distinctly with

honor in his adopted country, a prophet whose predictions are continually coming true.

Dr. Tesla bases his vast amount of work on wireless transmission and reception, on the marvelous phenomenon of terrestrial resonance, which he discovered in 1899, and on his magnifying transmitter. He considers the whole earth as a huge wire—or conductor—and, having determined its constants in electrical units, he has designed the proper wireless transmitter needed to set the globe into powerful electrical vibrations. According to this theory, if we desire to operate lights or motors, all we have to do is to connect an electrical capacity, such as an antenna, or other conductor, through the apparatus. If this theory is correct, and few engineers will make the positive statement that it is not, we shall have no more power transmission lines; we shall have an electrical capacity, in the

form of a ball or cylinder, placed in the attic or ceiling of a house, that, when connected through a Tesla transformer, to the earth, will pick up the desired electrical energy to operate our household devices. A meter may be connected with this arrangement so that the current may be measured and paid for in the usual way to the central station owners.

Dr. Tesla produced artificial lighting displays in his Colorado laboratory forty years ago, that have probably never since been equalled. Hundreds of patents cover his inventions, but thousands of his ideas have never been patented at all, and are recorded only in his private files.

No one knows what he will conceive next, but whatever it is, it will probably be sound in every principle. Tesla's name will go down to posterity as one of the greatest inventors and electrical discoverers of all time.



A Tesla experiment illustrating an inductive effect of an electrical oscillator of great power. Three ordinary incandescent lamps are lighted to full candle-power by currents induced in a local loop of single wire forming a square of fifty feet each side, which includes the lamps, and which is 100 feet distant from the primary circuit energized by the oscillator. The loop also includes an electrical condenser, and is exactly attuned to the vibrations of the oscillator, which is worked at less than five per cent of its total capacity.

Philosophy of Hu Shih, a Scholarly and Travelled Chinese

"To me that civilization is materialistic which is limited by matter and incapable of transcending it; which feels itself powerless against its material environment and fails to make the full use of human intelligence for the conquest of nature and for the improvement of the conditions of man . . .

"On the other hand, that civilization which makes the

fullest possible use of human ingenuity and intelligence in search of truth in order to control nature and transform matter for the service of mankind, to liberate the human spirit from ignorance, superstition, and slavery to the forces of nature, and to reform social and political institutions for the benefit of the greatest number—such a civilization is highly idealistic and spiritual."

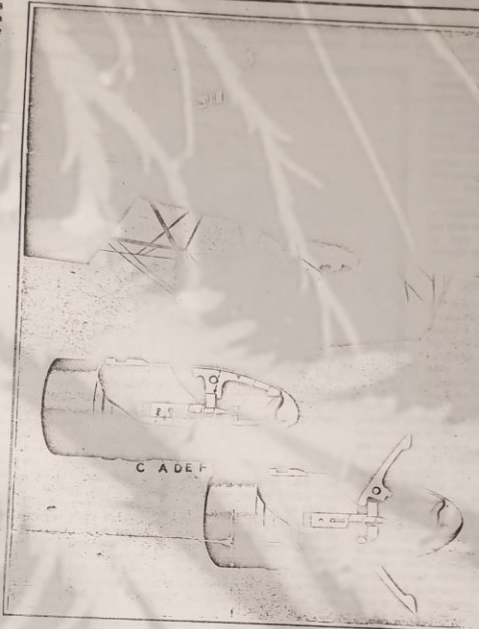
Inventions New and Interesting

Simple Patent Law: Patent Office News: Notes on Trademarks

Shells for Destroying Airships

THE recent raids on the English and French coast towns by the Zeppelin airships have given fresh point to the discussions of methods of defense against aerial cruisers of this sort, and how they can best be destroyed. It is evident to all who have considered the subject with a knowledge of the construction and character of these craft that a shot, even of large size, penetrating the huge gas reservoirs is not likely to have any serious effect, for the gas would be liberated so slowly from any ordinary sized hole that the vessel might not be seriously inconvenienced, and, even if eventually compelled to land on account of the injury, might easily keep the air until it reached friendly territory. To be effective, therefore, a projectile to be used against airships must be capable of producing an opening in the envelop of very considerable size.

It is interesting in this connection to note that the subject has not been overlooked by those who make a study of military subjects, as is indicated by a patent for a special projectile that was issued recently to the firm of Sir W. G. Armstrong, Whitworth & Co., the great builders of warships and guns. The invention is illustrated in the accompanying drawings. It will be seen that this projectile carries in longitudinal slots cut in its head a series of pivoted blades *B*, which ordinarily are held in place within the shell by a disk *F* on the firing pin *A*, which engages a notch *G* in an arm *I* of each blade. The firing pin *A* is normally held in place by a light shearing wire *C*; but when the projectile is fired from a gun the shock of the discharge, acting through the inertia of the firing pin *A*, causes the pin to be thrown backward, shearing the wire *C*, and releasing the blades *B*, which then open out as the result of air pressure or centrifugal force, and the projectile in this condition is capable of tearing an opening in the envelop of the airship several times the diameter of the shot itself, and the whirling motion of the projectile is expected to add to this result. But mere penetration



A new explosive projectile that tears open the gas bag of an airship.

will force the firing pin *A* forward, shearing the second restraining wire *E*, and driving the needle point *H* into contact with the detonator *I*, which explodes the shell. It will be seen that this explosion is calculated to take place within the body of the airship, with the result of disrupting the gas containers, and probably firing

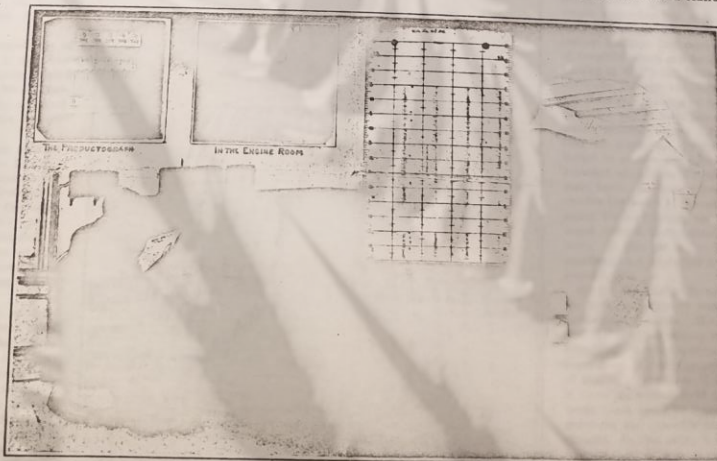
the gas as well, thus effectively destroying the craft, or at least compelling instant descent. Whether these shells have been brought into service or not has not been announced.

Watching Distant Machines from a Desk

By Herbert T. Wade

IN manufacturing and all other mechanical operations where an effort is made to *watch* the efficiency, or the *maximizing* results from a given plant or equipment, with a fixed or minimum expenditure of energy, power or personal attention, it is naturally of fundamental importance to secure an accurate knowledge of the performance of a given machine or individual. In short, efficiency studies may be divided roughly into those where the personal side, dealing with the laborer or operative, is paramount, and those where the output and performance of a given machine are investigated. Efficiency, in other words, is simply a ratio, and the higher the percentage of actual output or performance, as compared with possible performance or output, the greater the return to the wage payer or owner. The mechanical problem involved in studying the performance of a machine in its essence is of the simplest; a shaft makes so many revolutions, so many yards of cloth are woven by a loom, so many barrels of flour are packed at a roller mill, so much current passes through a recording wattmeter, an elevator travels so many miles on its daily travels, and a thousand and one other operations. All these items must be considered in relation to some unit of time as a rate of production or measure of efficiency, and must be indicated plainly to be digested by a responsible head of the plant. If one of ten machines is idle, the output is correspondingly decreased by 10 per cent for the length of time it is idle. If fewer yards of cloth are being wound off the loom than its rated production, there is a corresponding loss to the mill. Accordingly, any device that assembles for the information of a central head an actual record

of the performance of his machinery is invaluable, not only as an indication of what is happening at the instant, but as supplying a basis of comparative cost accounting. The efficiency studies should not stop at mere indication, *they* suggest, but be so presented as actually to secure increased efficiency, either by indicating at once the necessary repair or adjustment of machines, the addition of new and superior equipment, or the elimination of lost motion at one point or another along the line. To secure this elementary datum, and place it at the disposal of a cen-



Productographs in the manager's office that record the exact amount of work done by the different machines throughout the factory.

of the envelop of the gas compartment is not the only result expected of this new projectile, for it is constructed as an explosive shell containing a charge of high explosive, as shown at *J*. After the firing pin *A* has severed the restraining wire *C*, its movement is still limited by a second shearing wire *E*, that passes through a slot *D* in the pin, and no ordinary movement of the shell will result in its discharge. When, however, the extended blades *B* strike anything that causes resistance they are forced backward, and their extended rear ends acting on the disk *F*

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tral board, there has been evolved recently an instrument known as the productograph, which in connection with modern methods of economy and efficiency studies brings to a common center and there records the necessary data as to the mechanical operation of a plant, whether the various elements or machines of the same are separated by considerable distance or not. The productograph consists essentially of a special form of clock, corresponding with the operation of a machine or mechanism. Such a device in essence might be of the simplest character, but in this new

system the switch is arranged so that lever for every motion and for of its teeth, while a second wheel carrying a cam mounted on the same axle does not operate a lever connected with a dash pot and electric circuit breaking mechanism, until the first wheel has been advanced by ten teeth, corresponding of course to ten seconds.

Then a circuit is completed and current, which is supplied at low voltage from a special motor generator set, is sent over a conductor to the indicating mechanism. The pneumatic cylinder of the switch prevents absolutely any short circuit. The indicating mechanism consists of a series of electromagnets, one magnet for each circuit, each, however, supplied with two armatures, one of which actuates an indicator having numbers on the faces of its dials or revolving wheels by which the number of revolutions or other movements of the switch are shown, while the other armature and mechanism is connected with a German silver pin or needle point, which on the closing of the circuit makes a line on a strip of lead paper driven by clockwork, so that a graphic record appears in the spaces divided to represent hours and minutes. The mechanism is so arranged that each tooth stroke is longer through the increased motion of the armature, and as each stroke corresponds with ten movements of the original switch, the long marks on the record indicate 100 movements of the machine.

As actually installed in many plants a number of these recording devices are combined; as many as twenty have been arranged together, and while they are all similar in their general action, yet the information they supply may cover a wide range of activities. Thus in a large printing plant one switch may be attached to a linotype machine and the number of lines set by the operator be registered automatically on the dial. Another machine may be connected to a press and give the number of sheets printed, while another in the bindery may indicate the number of books bound. Yet before the manager's eye the complete activity of the plant is apparent.

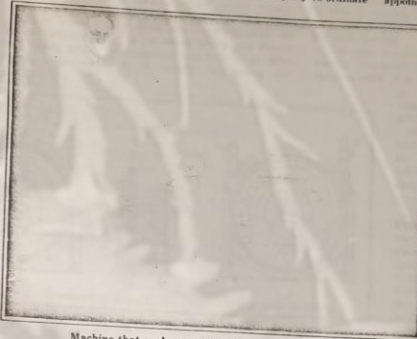
Again in other establishments the number of bottles filled, the number of defective bottles, the number of cases, the amount of liquid passing into a tank; the amount of coal weighed into the coal elevator, the number of movements of a dredge bucket; and, in fact, all desired information immediately and quantitatively is recorded.

In all efficiency studies knowledge of conditions and performance is the first consideration, and with this accumulated by a device which indicates also the production, the efficiency engineer or superintendent can proceed to better his output.

Realizing as he can at a glance, that machine No. 10 was idle for two hours, it is possible to investigate the reason and to provide against such shortcomings in the future, whether they are the result of personal or mechanical causes. If another machine supplies but a fraction of the output of its neighbor it does not take very long for the efficiency engineer to determine the fact and to change conditions.

The records are available for analysis either by the managers of the plant or by trained outside experts, and the logical development would seem to be a central office of efficiency where a superintendent would analyze not once a year, but once an hour or at even a less interval what is happening within the walls of his factory, or, in fact, within several allied establishments. So far the system has been made with twenty indicators, but there seems to be no limit as to its application either in extent or in range. The

current, which amounts to but one half ampere per needle, may be derived from any lighting circuit, either alternating or direct, preferably through a motor-generator, and the low voltage of the operating circuit does not present any difficulty in the way of expense either for installation or maintenance. While all efficiency studies and work are fundamentally part, and of these the productograph is typical of what may be used in order to secure and properly co-ordinate



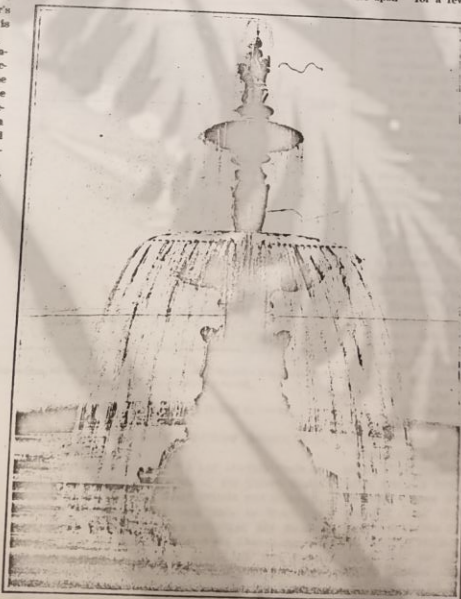
Machine that seals one thousand envelopes per minute.

the knowledge on which mechanical efficiency must depend.

The Envelop Scaler of the Pension Office

As may well be imagined, the envelop output of the Disbursement Office of the United States Pension Office, at Washington, D. C., is very large indeed, and there has been a demand for a machine of large capacity for scaling envelopes. Realizing this need an assistant messenger of the office, Mr. Fred W. Carrington, undertook to build a machine of the type required. In this he was successful. The capacity of the machine so far as has been tested is from seven hundred to a thousand or more envelopes per minute.

The envelopes can be placed in a bunch or bundle upon



Nikola Tesla's fountain, in which remarkable results are obtained with little water.

the feed belt, and will automatically feed themselves into the machine and pass out at the delivery end properly sealed.

At present the receptacle for the sealed and delivered envelopes is not in the most satisfactory form, and will constitute the subject of another invention. A patent on this machine was granted to Mr. Carrington on December 15th, 1914 (No. 1,120,688), and he has dedicated it to the public. As a reward for his ingenuity and service to the Government, President Wilson has appointed Mr. Carrington to the chief grade without

examination under the Civil Service Commission. The features of Mr. Carrington's machine, which are regarded as of considerable importance, are the means of adapting it for envelopes of different sizes, and particularly a feed belt of corrugated rubber, which is laid off in sections, the belt being operated rapidly to feed the envelope one at a time into the machine. The molding means includes a set of water heated by an alcohol lamp, it having been found that the machine operates so rapidly that cold water will not soften the glue of the envelopes in the short space of time in which the envelope passes through the machine.

Nikola Tesla's Fountain

It is a curious fact that, old as fountains are, they have remained essentially unchanged in principle for centuries. Artists have lavished all their skill upon them to make them beautiful, but engineers have neglected them. To be sure independent pumps of small volumetric capacity have been used to create artificial waterfalls and to use the same water over and over again. But this principle is old and the spectacle offered to the eye not a great improvement over the fountains of olden times.

Two types of fountain have chiefly prevailed—the cascade in which a moderate volume of water falls in thin but brilliant sheets over multiplied obstructions—steps, basins, rocks, etc.—always in a framework of architecture with abundant obstructive accessories; and the isolated or central fountain, in which one or many jets, spouted upward, fall into the highest of a series of superposed bowls of marble or bronze and then into a larger one below and so on into a broad basin at the ground level. Although every effort was made to save water and to obtain the maximum effect, still we find that in most European cities, fountains are allowed to play only on certain days of the week, and then only for a few hours. It may be safely said that not since

the days of the Italian Renaissance has any really startling improvement been made in the hydraulics of fountains.

Into this neglected field, Mr. Nikola Tesla, the distinguished engineer, has entered, and as might be expected of him, with very striking results. He has recently patented a fountain of entirely new principle, and one moreover in which imposing effects are obtained with very simple apparatus and with a very small volume of water. The accompanying illustration pictures the very simplest form of fountain which can be constructed, according to Mr. Tesla's ideas. A shaft runs vertically through the central column of the fountain, carrying at its lower end a propeller, and at its upper end an electric motor, suitably braced. In our illustration we show this propeller shaft contained in a tube, the bottom of which is provided with inlets for the water in the main bowl. As the propeller is made to revolve the water is sucked in by the propeller blades through the inlets, and is urged upward in the direction of the arrows. It fills the upper bowl and then overflows in a miniature waterfall of impressive size.

As the circulation is extremely rapid, the total quantity of water required is comparatively small. About one tenth of that delivered per minute will be generally sufficient. In this fountain then, we find a great mass of water propelled by the use of only such power as is required to lift it from its normal level through a relatively short space to that from which it overflows and descends as a waterfall or cascade. In that sense it is a radical departure from historic fountains.

The apparatus not only makes the breeding of insects impossible, but is in a sense a very efficient trap.

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In the case of the present turbine, the particles of the fluid complete a number of turns around the shaft before reaching the exhaust, covering in the meantime a linear path some 12 to 16 feet in length. During its progress from inlet to exhaust, the velocity and pressure of the steam are reduced until it leaves the exhaust at 1 or 2 pounds gage pressure.

The resistance to the passage of the steam or gas between adjoining plates is approximately proportionate to the square of the relative speed, which is at a maximum toward the center of the disks and is equal to the tangential velocity of the steam. Hence the resistance to radial escape is very great, being further enhanced by the centrifugal force acting outwardly. One of the most desirable elements in a perfected turbine is that of reversibility, and we are all familiar with the many and frequently cumbersome means which have been employed to secure this end. It will be seen that this turbine is admirably adapted for reversing, since this effect can be secured by merely closing the right-hand valve and opening that on the left.

It is evident that the principles of this turbine are equally applicable, by slight modifications of design, for its use as a pump, and we present a photograph of a demonstration model which is in operation in Mr. Tesla's office. This little pump, driven by an electric motor of 1/12 horse-power, delivers 40 gallons per minute against a head of 5 feet. The discharge pipe leads up to a horizontal tube provided with a wire mesh for screening the water and checking the eddies. The water falls through a slot in the bottom of this tube and after passing below a baffle plate flows in a steady stream about 3/4 inch thick by 12 inches in width, to a trough from which it returns to the pump. Pumps of this character show an efficiency favorably comparing with that of centrifugal pumps and they have the advantage that great heads are obtained in a two-part volute casing and except for ordinary centrifugal pump is taken by a set of disks, of the standard kind.

In conclusion, it should be noted that although the experimental plant at the Watervliet station develops 200 horse-power with 125 pounds at the supply pipe and free exhaust, it could show an output of 300 horse-power with the full pressure of the Edison supply circuit. Furthermore, Mr. Tesla states that if it were compounded and the exhaust were led to a low pressure unit, carrying about three times the number of disks contained in the high pressure element, with connection to a condenser affording 28 1/2 to 29 inches of vacuum, the results obtained in the present high-pressure machine indicate that the compound unit would give an output of 600 horse-power, without great increase of dimensions. This estimate is conservative.

The testing plant consists of two identical turbines connected by a carefully calibrated torsion spring, the machine to the left being the driving element, the other the brake. In the brake element, the steam is delivered to the blades in a direction opposite to that of the rotation of the disks. Fastened to the shaft of the brake turbine is a hollow pulley provided with two diametrically opposite narrow slots, and an incandescent lamp placed inside close to the rim. As the pulley rotates, two flashes of light pass out of the slots, and by means of reflecting mirrors and lenses, they are carried around the plant and fall upon two rotating glass mirrors placed back to back on the shaft of the driving turbine so that the center line of the silver coatings coincides with the axis of the shaft. The mirrors are so set that when there is no torsion on the spring, the light beams produce a luminous spot stationary at the zero of the scale. But as soon as load is put on, the beam is deflected through an angle which indicates directly the torsion. The scale and spring are so proportioned and adjusted that the horse-power can be read directly from the deflection noted. The indications of this device are very accurate and have shown that when the turbine is running at 3,600 revolutions under an inlet pressure of 125 pounds to the square inch, and with free exhaust, 200 brake horse-power are developed. The consumption under these conditions of maximum output is 33 pounds of saturated steam per horse-power per hour—a very

high efficiency when we consider that the heat-drop measured by thermometers, is only 139 B.T.U., and that the energy transformation is effected in one stage. Since about three times this number of heat units are available in a modern plant with superheated steam, the above means a consumption of less than 12 pounds per horse-power hour in such turbines adapted to take up the full drop. Under certain conditions, however, very high thermal efficiencies have been obtained which demonstrate that in large machines based on this principle, in which a very small slip can be secured, the steam consumption will be much lower and should, Mr. Tesla states, approximate the theoretical minimum, thus resulting in nearly frictionless tur-

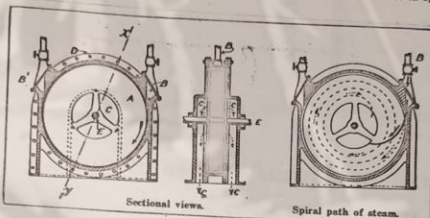
while all the coal which had been mined prior to 1895 was 3,138,174,119 tons.

Incredible as it may seem, at the present rate of increase the ten-year period between 1905 and 1915 will show a production greater than all the coal mined in the United States prior to 1905. In 1850 the per capita production of coal was a little over one-fourth of a ton. In 1870 the per capita production had increased to nearly one ton; in 1890 it was 2 1/2 tons; in 1900 it was 3 1/2 tons, and in 1910 with the population of 91,273,255 the production was nearly 5 1/2 tons for each person.

Last year 725,820 men mined coal in the United States. The great coal production record of 1910 was made in spite of a series of labor strikes participated in by 215,649 men. The loss in wages alone amounted to nearly \$20,000,000.

The quantity of coal used for making coke in the United States for metallurgical purposes was 52,187,450 tons. This is additional to by-product coke produced in gas manufacture.

The total production of coal in the United States at the close of 1910 was 8,243,351,259 short tons. This plus the estimated loss incident to mining makes a total exhaustion of 13,395,000,000 tons. The United States Geological Survey estimates the original supply of coal in the ground in the United States, exclusive of Alaska, at 3,875,294,000,000 tons. This original supply less the exhaustion at the close of 1910 leaves an apparent supply still available of 2,962,308,972,000 tons, or 99.6 per cent of the original supply. In other words, in all the time since coal mining began in the United States the draft upon the original supply including loss in mining, has amounted to less than one-half of one per cent. At the present rate of production of approximately half a billion tons a year the coal reserve of the United States would therefore last 6,000 years. At the present rate of increase in production, however, these three thousand billion tons of coal in the ground would last only a few generations.

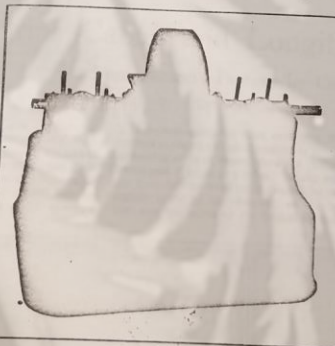


Details of turbine.

bine transmitting almost the entire expansive energy of the steam to the shaft.

Some Striking Coal Facts

LAST year the United States mined 501,596,378 short tons of coal or nearly two-fifths of the year's total production for the world. This coal would load States from the Atlantic to the Pacific 33 times—a train approximately 100,000 miles long. Eleven years ago the United States for the first time surpassed Great Britain with a production of 253,741,192 tons. Only a little more than half of last year's output. The mere increase of the coal output of the United States for 1910 over that of 1899—16,731,162 tons—was greater than the total production of any foreign



This turbine, whose rotor consists simply of a set of flat disks 18 inches in diameter, develops 200 brake horse-power on test.

Turbine with upper half of casing removed.

country except Great Britain, Germany, Austria, Hungary, or France.

This increase alone was one and one-fifth times as great as the entire production of the United States in 1870. Excepting only Great Britain and Germany, either of the States of Pennsylvania or West Virginia produced in 1910 more coal than any foreign country. For the past seven or eight 10-year periods the coal production for each decade has been about equal to the entire amount of coal previously mined in the United States. Thus in the 10 years between 1835 and 1895 the production was 1,585,095,641 tons, while the entire amount of coal mined prior to 1835 was only 1,552,980,478 tons. In the 10 years between 1885 and 1905 the production was 2,832,402,746 tons,

Foreign Students in America

ADDRESSING the House of Representatives on the many new activities of the United States diplomatic service, Representative Foster, of Vermont, late chairman of the House Foreign Affairs Committee, recently called attention to the effort made by our diplomatic and consular representatives to advertise the United States as an educational center, an undertaking that has been fruitful of results.

One of the outcomes of this program was the formation in Buenos Aires two years ago of a United States University Club, which has been the means of sending at least 20 young Argentines to this country to be educated. Under the auspices of this club lectures are given on university life in the United States, illustrated with a large number of appropriate stereopticon views. Negotiations are now under way for an interchange of schoolboys between the Boston High School of Commerce and the preparatory department of the University of La Plata. There are now at least 400 Latin Americans studying in the United States, and the number is steadily increasing.

Through the efforts of our ambassador at Constantinople, supported by the State Department, Columbia University has voted to receive, free of all tuition charges, three students annually from the Ottoman Empire for the next ten years, to pursue courses of study in any of the departments of the university. These students are to be selected by the Ottoman government, with the advice and approval of the ambassador at Constantinople.

The education of Chinese students in America, a matter in which the United States government has always taken a kindly interest, is assuming ever larger proportions. These students now number between 800 and 900. Half of these are "government students," supported by the different Chinese provinces, and by the remitted portion of the Boxer indemnity fund. To insure that the indemnity students coming to the United States should not start with a serious handicap, but be fully prepared to enter the American colleges, an academy has been established in Peking by the Chinese government, where these students receive preliminary instructions under American teachers.

NIKOLA TESLA PAPERS

BINDER 4

Columbia University Library

Boxes III (con't.), IV, V, and VI.

CORRESPONDENCE --

Box IV: JULIAN HAWTHORNE; FRANCIS M. HUGO.

(Off. of Sec'y of State, N.Y.); FRITZ

LOWENSTEIN; N.Y. State Comptroller's Off.;


Wisconsin Electric Co. and Standard

Underground Cable Co. with George Scherff;

GEORGE SCHERFF; DICKSON D. ALLEY.

Box V: GEORGE SCHERFF

Box VI: Manuscript writings.



MECHANICAL THERAPY

By

NIKOLA TESLA

In order to convey a clear idea of the significance and revolutionary character of this discovery it is indispensable to make a brief statement regarding ELECTRICAL THERAPY.

Fifty years ago, while investigating high frequency currents developed by me at that time, I observed that they produced certain physiological effects offering new and great possibilities in medical treatment. My first announcement spread like fire and experiments were undertaken by a host of experts here and in other countries. When a famous French physician, Dr. D'Arsenval, declared that he had made the same discovery, a heated controversy relative to priority was started. The French, eager to honor their countryman, made him a member of the Academy, ignoring entirely my earlier publication. Resolved to take steps for vindicating my claim, I went to Paris, where I met Dr. D'Arsenval. His personal charm disarmed me completely and I abandoned my intention, content to rest on the record. It shows that my disclosure antedated his and also that he used my apparatus in his demonstrations. The final judgment is left to posterity.

Since the beginning, the growth of the new art and industry has been phenomenal, some manufacturers turning out daily hundreds of sets. Many millions are now in use throughout the world. The currents furnished by them have proved an ideal tonic for the human nerve system. They promote heart action and digestion, induce healthful sleep, rid the skin of destructive exudations and cure colds and fever by the warmth they create. They vivify atrophied or paralyzed parts of the body, allay all kinds of suffering and save annually thousands of lives. Leaders in the profession have assured me that I have done more for humanity by this medical treatment than by all my other discoveries and inventions. Be that as it may, I feel certain that the MECHANICAL THERAPY, which I am about to give to the world, will be of incomparably greater benefit. Its discovery was made accidentally under the following circumstances.



- 2 -

I had installed at the laboratory, 35 South Fifth Avenue, one of my mechanical oscillators with the object of using it in the exact determination of various physical constants. The machine was bolted in vertical position to a platform supported on elastic cushions and, when operated by compressed air, performed minute oscillations absolutely isochronous, that is to say, consuming rigorously equal intervals of time. So perfect was its functioning in this respect that clocks driven by it indicated the hour with astronomical precision. One day, as I was making some observations, I stepped on the platform and the vibrations imparted to it by the machine were transmitted to my body. The sensation experienced was as strange as agreeable, and I asked my assistants to try. They did so and were mystified and pleased like myself. But a few minutes later some of us, who had stayed longer on the platform, felt an unspeakable and pressing necessity which had to be promptly satisfied, and then a stupendous truth dawned upon me. Evidently, these isochronous rapid oscillations stimulated powerfully the peristaltic movements which propel the food-stuffs through the alimentary channels. A means was thus provided whereby their contents can be perfectly regulated and controlled at will, and without the use of drugs, specific remedies or internal applications whatever.

When I began to practice with my assistants MECHANICAL THERAPY we used to finish our meals quickly and rush back to the laboratory. We suffered from dyspepsia and various stomach troubles, biliousness, constipation, flatulence and other disturbances, all natural results of such irregular habit. But after only a week of application, during which I improved the technique and my assistants learned how to take the treatment to their best advantage, all these forms of sickness disappeared as by enchantment and for nearly four years, while the machine was in use, we were all in excellent health. I cured a number of people, among them my great friend



- 3 -

Mark Twain whose books saved my life. He came to the laboratory in the worst shape suffering from a variety of distressing and dangerous ailments but in less than two months he regained his old vigor and ability of enjoying life to the fullest extent. Shortly after, a great calamity befell me: my laboratory was destroyed by fire. Nothing was insured and the loss of priceless apparatus and records gave me a terrific shock from which I did not recover for several years. The enforced discontinuance of MECHANICAL THERAPY also caused me deep regret. I had evolved a wonderful remedy for ills of inestimable value to mankind and invented apparatus offering unbounded commercial possibilities but when I came to consider practical introduction I realized that it was entirely unsuitable. It was big, heavy and noisy, called for a continuous supply of oil, part of which was discharged in the room as fine spray; it consumed considerable power and required a number of objectionable accessories. During the succeeding years I made great improvements and finally evolved a design which leaves nothing to be desired. The machine will be very small and light, operate noiselessly without any lubricant, consume a trifling amount of energy and will be, to my knowledge, the most beautiful device ever put on the market. The intention is to exhibit it in action at the occasion of my annual reception in honor of the Press which has been, unfortunately, delayed this year, and I anticipate that it will elicit great interest and receive wide publicity. Unless I am grossly mistaken it will be introduced very extensively and, eventually, there will be one in every household.

The practical application of MECHANICAL THERAPY through my oscillators will profoundly affect human life. By insuring perfect regularity of evacuations the body will function better in every respect



- 4 -

and life will become ever so much safer and more enjoyable. One of the most important results will be the great reduction -- amounting possibly to seventy-five per cent -- in the number of heart failures, which are mostly caused by some acute upset of the digestive process and normal operation of the stomach. Another vital improvement will be derived from the quickened removal of toxic accumulations of organs affected by disease. It is reasonable to expect that through this and other healthful actions ulcers and similar internal lesions or abscesses will be cured and relief might be obtained even in case of a cancer or other malignant growth. Skilled physicians and surgeons will be able to perform veritable miracles with such oscillations. They stimulate strongly the liver, spleen, kidneys, bladder and other organs and by these desirable actions they must contribute not a little to well being. Persons suffering from anemia of any form will be especially helped by the treatment. But the greatest benefit will be derived from it by women who will be able to reduce without the usual tantalizing abstinence, privation, sacrifice of time and money and torture they have to endure. They will improve much in appearance, acquire clear eyes and complexions and it may be safely predicted that long continued treatment will bring forth feminine beauty never seen before. It is not to be forgotten that the elimination of countless drugs, patent medicines and specific remedies of all kinds taken internally, by which millions of people doom themselves to an early grave, will be of untold good to humanity.

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MY INVENTIONS

by Nikola Tesla.

VI. The Art of Telautomatics.

How Tesla's Mind Recuperates.

No subject to which I have ever devoted myself has called for such concentration of mind and strained to so dangerous a degree the finest fibers of my brain as the system of which the Magnifying Transmitter is the foundation. I put all the intensity and vigor of youth in the development of the rotating field discoveries, but those early labors were of a different character. Although strenuous in the extreme, they did not involve that keen and exhausting discernment which had to be exercised in attacking the many puzzling problems of the wireless. Despite my rare physical endurance at that period the abused nerves finally rebelled and I suffered a complete collapse, just as the consummation of the long and difficult task was almost in sight. Without doubt I would have paid a greater penalty later, and very likely my career would have been prematurely terminated, had not providence equipped me with a safety device, which has seemed to improve with advancing years and unfailingly comes into play when my forces are at an end. So long as it operates I am safe from danger, due to overwork, which threatens other inventors and, incidentally, I need no vacations

which are indispensable to most people. When I am all but used up I simply do as the darkies, who "naturally fall asleep while white folks worry". To venture a theory out of my sphere - the body probably accumulates little by little a definite quantity of some toxic agent and I sink into a nearly lethargic state which lasts half an hour to the minute. Upon awakening I have the sensation as though the events immediately preceding had occurred very long ago, and if I attempt to continue the interrupted train of thought I feel a veritable mental nausea. Involuntarily I then turn to other work and am surprised at the freshness of the mind and ease with which I overcome obstacles that had baffled me before. After weeks or months my passion for the temporarily abandoned invention returns and I invariably find answers to all the vexing questions with scarcely any effort.

In this connection I will tell of an extraordinary experience which may be of interest to students of psychology. I had produced a striking phenomenon with my grounded transmitter and was endeavoring to ascertain its true significance in relation to the currents propagated through the earth. It seemed a hopeless undertaking and for more than a year I worked unremittingly but in vain. This profound study so entirely absorbed me that I became forgetful of everything else, even of my undermined health. At last, as I was at the point of breaking down, nature applied the preservative inducing lethal sleep. Regaining my senses, I realized with consternation that I was

unable to visualize scenes from my life except those of infancy, the very first ones that had entered my consciousness. Curiously enough, these appeared before my vision with startling distinctness and afforded me welcome relief. Night after night, when retiring, I would think of them and more and more of my previous existence was revealed. The image of my mother was always the principal figure in the spectacle that slowly unfolded, and a consuming desire to see her again gradually took possession of me. This feeling grew so strong that I resolved to drop all work and satisfy my longing. But I found it too hard to break away from the laboratory and several months elapsed during which I had succeeded in reviving all the impressions of my past life up to the spring of 1892. In the next picture that came out of the mist of oblivion, I saw myself at the Hotel de la Paix in Paris just coming to from one of my peculiar sleeping spells, which had been caused by prolonged exertion of the brain. Imagine the pain and distress I felt when it flashed upon my mind that a dispatch was handed to me at that very moment bearing the sad news that my mother was dying; I remembered how I made the long journey home without an hour of rest and how she passed away after weeks of agony! It was especially remarkable that during all this period of partially obliterated memory I was fully alive to everything touching on the subject of my research. I could recall the smallest details and the least insignificant observations in my experiments and even recite pages of text and complex mathematical formulae.

My belief is firm in a law of compensation. The true rewards are ever in proportion to the labor and sacrifices made. This is one of the reasons why I feel certain that of all my inventions, the Magnifying Transmitter will prove most important and valuable to future generations. I am prompted to this prediction not so much by thoughts of the commercial and industrial revolution which it will surely bring about, but of the humanitarian consequences of the many achievements it makes possible. Considerations of mere utility weigh little in the balance against the higher benefits of civilization. We are confronted with portentous problems which can not be solved just by providing for our material existence, however abundantly. On the contrary, progress in this direction is fraught with hazards and perils not less menacing than those born from want and suffering. If we were to release the energy of atoms or discover some other way of developing cheap and unlimited power at any point of the globe this accomplishment, instead of being a blessing, might bring disaster to mankind in giving rise to dissension and anarchy which would ultimately result in the enthronement of the hated regime of force. The greatest good will come from technical improvements tending to unification and harmony, and my wireless transmitter is preëminently such. By its means the human voice and likeness will be reproduced everywhere and factories

driven thousands of miles from waterfalls furnishing the power; aerial machines will be propelled around the earth without a stop and the sun's energy controlled to create lakes and rivers for motive purposes and transformation of arid deserts into fertile land. Its introduction for telegraphic, telephonic and similar uses will automatically cut out the statics and all other interferences which at present impose narrow limits to the application of the wireless. This is a timely topic on which a few words might not be amiss.

Tesla Raps "Static" Men Vigorously.

During the past decade a number of people have arrogantly claimed that they had succeeded in doing away with this impediment. I have carefully examined all of the arrangements described and tested most of them long before they were publicly disclosed, but the finding was uniformly negative. A recent official statement from the U. S. Navy may, perhaps, have taught some beguileable news editors how to appraise these announcements at their real worth. As a rule the attempts are based on theories so fallacious that whenever they come to my notice I can not help thinking in a lighter vein. Quite recently a new discovery was heralded, with a deafening flourish of trumpets, but it proved another case of a mountain bringing forth a mouse. This reminds me of an exciting incident which took place years ago when I was conducting my experiments with currents of high frequency. Steve Brodie had just jumped off the Brooklyn Bridge. The feat has been vulgarized since by imitators, but the

first report electrified New York. I was very impressionable then and frequently spoke of the daring printer. On a hot afternoon I felt the necessity of refreshing myself and stepped into one of the popular thirty thousand institutions of this great City where a delicious twelve per cent beverage was served which can now be had only by making a trip to the poor and devastated countries of Europe. The attendance was large and not over-distinguished and a matter was discussed which gave me an admirable opening for the careless remark: "This is what I said when I jumped off the bridge". No sooner had I uttered these words than I felt like the companion of Timotheus in the poem of Schiller. In an instant there was a pandemonium and a dozen voices cried: "It is Brodie!" I threw a quarter on the counter and bolted for the door but the crowd was at my heels with yells: "Stop, Steve!" which must have been misunderstood for many persons tried to hold me up as I ran frantically for my haven of refuge. By darting around corners I fortunately managed - through the medium of the fire-escape - to reach the laboratory, which I threw off my coat, camouflaged myself as a hard working blacksmith, and started the forge. But these precautions proved unnecessary; I had eluded my pursuers. For many years afterward, at night, when imagination turns into spectres the trifling troubles of the day, I often thought, as I tossed on the bed, what my fate would have been had that mob caught me and found out that I was not Steve Brodie!

Now the engineer, who lately gave an account before a technical body of a novel remedy against statics based on a "heretofore unknown law of nature", seems to have been as reckless as myself when he contended that these disturbances propagate up and down, while those of a transmitter proceed along the earth. It would mean that a condenser, as this globe, with its gaseous envelop, could be charged and discharged in a manner quite contrary to the fundamental teachings propounded in every elemental text-book of physics. Such a supposition would have been condemned as erroneous, even in Franklin's time, for the facts bearing on this were then well-known and the identity between atmospheric electricity and that developed by machines was fully established. Obviously, natural and artificial disturbances propagate through the earth and the air in exactly the same way, and both set up electro-motive forces in the horizontal, as well as vertical, sense. Interference can not be overcome by any such methods as were proposed. The truth is this: In the air the potential increases at the rate of about fifty volts per foot of elevation, owing to which there may be a difference of pressure amounting to twenty, or even forty thousand volts between the upper and lower ends of the antennae. The masses of the charged atmosphere are constantly in motion and give up electricity to the conductor, not continuously but rather disruptively, this producing a grinding noise in a sensitive telephonic

receiver. The higher the terminal and the greater the space encompassed by the wires, the more pronounced is the effect, but it must be understood that it is purely local and has little to do with the real trouble. In 1900, while perfecting my wireless system, one form of apparatus comprised four antennae. These were carefully calibrated to the same frequency and connected in multiple with the object of magnifying the action, in receiving from any direction. When I desired to ascertain the origin of the transmitted impulses, each diagonally situated pair was put in series with a primary coil energizing the detector circuit. In the former case the sound was loud in the telephone; in the latter it ceased, as expected, the two antennae neutralizing each other, but the true statics manifested themselves in both instances and I had to devise special preventives embodying different principles.

The Remedy For Statics.

By employing receivers connected to two points of the ground, as suggested by me long ago, this trouble caused by the charged air, which is very serious in the structures as now built, is nullified and besides, the liability of all kinds of interference is reduced to about one-half, because of the directional character of the circuit. This was perfectly self-evident, but came as a revelation to some simple-minded wireless folks whose experience was confined to forms of apparatus that could have been improved with an axe, and they have been disposing of the bear's skin before

killing him. If it were true that strays performed such antics, it would be easy to get rid of them by receiving without serials. But, as a matter of fact, a wire buried in the ground which, conforming to this view, should be absolutely immune, is more susceptible to certain extraneous impulses than one placed vertically in the air. To state it fairly, a slight progress has been made, but not by virtue of any particular method or device. It was achieved simply by disordering the enormous structures, which are bad enough for transmission but wholly unsuitable for reception, and adopting a more appropriate type of receiver. As I pointed out in a previous article, to dispose of this difficulty for good, a radical change must be made in the system, and the sooner this is done the better.

Radio Government Control Not Wanted.

It would be calamitous, indeed, if at this time when the art is in its infancy and the vast majority, not excepting even experts, have no conception of its ultimate possibilities, a measure would be rushed through the legislature making it a Government monopoly. This was proposed a few weeks ago by Secretary Daniels, and no doubt that distinguished official has made his appeal to the Senate and House of Representatives with sincere conviction. But universal evidence unmistakably shows that the best results are always obtained in healthful commercial competition. There are, however, exceptional reasons why ^{wireless} A should be given the fullest freedom of

development. In the first place it offers prospects immeasurably greater and more vital to betterment of human life than any other invention or discovery in the history of man. Then again, it must be understood that this wonderful art has been, in its entirety, evolved here and can be called "American" with more right and propriety than the telephone, the incandescent lamp or the aeroplane. Enterprising press agents and stock jobbers have been so successful in spreading misinformation that even so excellent a periodical as the Scientific American accords the chief credit to a foreign country. The Germans, of course, gave us the Hertz-waves and the Russian, English, French and Italian experts were quick in using them for signalling purposes. It was an obvious application of the new agent and accomplished with the old classical and unimproved induction coil-scarcely anything more than another kind of heliography. The radius of transmission was very limited, the results attained of little value, and the Hertz oscillations, as a means for conveying intelligence, could have been advantageously replaced by sound-waves, which I advocated in 1891. Moreover, all these attempts were made three years after the basic principles of the wireless system, which is universally employed today, and its potent instrumentalities had been clearly described and developed in America. No trace of those Hertzian appliances and methods remains today. We have proceeded in the very opposite direction and what has been done is the product of the brains and efforts of citizens of this country. The fundamental patents have expired and the opportunities are open to all. The chief argument of the Secretary is based on interference. According to his statement reported in the New York Herald of July 29th, signals from a powerful station can be intercepted in every village of the world. In view of this fact, which was demonstrated in my experiments of 1900, it would be of little

America First.

use to impose restrictions in the United States. PAs throwing light on this point, I may mention that only recently an odd looking gentleman called on me with the object of enlisting my services in the construction of world transmitters in some distant land. "We have no money," he said, "but carloads of solid gold and we will give you a liberal amount." I told him that I wanted to see first what will be done with my inventions in America and this ended the interview. But I am satisfied that some dark forces are at work, and as time goes on the maintenance of continuous communication will be rendered more difficult. The only remedy is a system immune against interruption. It has been perfected, it exists, and all that is necessary is to put it in operation.

The terrible conflict is still uppermost in the minds and perhaps the greatest importance will be attached to the Magnifying Transmitter as a machine for attack and defense, more particularly in connection with telautomats. This invention is a logical outcome of observations begun in my boyhood and continued throughout my life. When the first results were published, the Electrical Review stated editorially that it would become one of the "most potent factors in the advance and civilization of mankind". The time is not distant when this prediction will be fulfilled. In 1898 and 1900 it was offered to the Government and might have been adopted were I

one of those who would go to Alexander's shepherd when they want something from Alexander. At that time I really thought that it would abolish war, because of its unlimited destructiveness and elimination of the personal element of combat. But while I have not lost faith in its potentialities, my views have changed since.

The Road To Permanent Peace.
War can not be avoided until the physical cause

for its recurrence is removed and this, in the last analysis, is the vast extent of the planet on which we live. Only through annihilation of distance in every respect as, the conveyance of intelligence, transport of passengers and supplies and transmission of energy will conditions be brought about some day, insuring permanency of friendly relations. What we now want most is closer contact and better understanding between individuals and communities all over the earth, and the elimination of that fanatic devotion to exalted ideals of national egoism and pride which is always prone to plunge the world into primeval barbarism and strife. No League or parliamentary act of any kind will ever prevent such a calamity. These are only new devices for putting the weak at the mercy of the strong. I have expressed myself in this regard fourteen years ago when a combination of few leading governments - a sort of Holy Alliance - was advocated by the late Andrew Carnegie, who may be fairly considered as

the father of this idea, having given to it more publicity and
impetus ^{than anybody else} prior to the efforts of the President. While it can
not be denied that such a pact might be of material advantage
to some less fortunate peoples, it can not attain the chief
object sought. Peace can only come as a natural consequence
of universal enlightenment and merging of races, and we are
still far from this blissful realization. As I view the
world of today, in the light of the gigantic struggle we have
witnessed, I am filled with conviction that the interests of
humanity would be best served if the United States remained
true to its traditions and kept out of "entangling alliances".
Situating as it is, geographically, remote from the theaters
of impending conflicts, without incentive to territorial
aggrandizement, with inexhaustible resources, and immense
population thoroughly imbued with the spirit of liberty and
right, this country is placed in a unique and privileged
position. It is thus able to exert, independently, its col-
ossal strength and moral force to the benefit of all, more
judiciously and effectively, than as member of a league.

The Mechanistic Theory of Life.

In one of these biographical sketches, published in the Electrical Experimenter, I have dwelt on the circumstances of my early life and told of an affliction which compelled me to unremitting exercise of imagination and self-observation. This mental activity, at first involuntary under the pressure of illness and suffering, gradually became second nature and led me finally to recognize that I was but an automaton devoid of free will in thought and action and merely responsive to the forces of the environment. Our bodies are of such complexity of structure, the motions we perform are so numerous and involved, and the external impressions on our sense organs to such a degree delicate and elusive that it is hard for the average person to grasp this fact. And yet nothing is more convincing to the trained investigator than the mechanistic theory of life which had been, in a measure, understood and propounded by Descartes three hundred years ago. But in his time many important functions of our organism were unknown and, especially with respect to the nature of light and the construction and operation of the eye, philosophers were in the dark. In recent years the progress of scientific research in these fields has been such as to leave no room for a doubt in regard to this view on which many works have been published. One of its ablest and most eloquent exponents is, perhaps, Felix Le Dantec, formerly assistant of Pasteur. Prof. Jacques Loeb has performed remarkable experiments in heliotropism, clearly establishing the controlling power of light in

lower forms of organisms and his latest book "Fixed Movements" is revelatory. But while men of science accept this theory simply as any other that is recognized, to me it is a truth which I hourly demonstrate by every act and thought of mine. The consciousness of the external impression prompting me to any kind of exertion, physical or mental, is ever present in my mind. Only on very rare occasions, when I was in a state of exceptional concentration, have I found difficulty in locating the original impulses. ^{the} The by far greater ^{number} of human beings are never aware of what is passing around and within them, and millions fall victims of disease and die prematurely just on this account. The commonest, everyday occurrences appear to them mysterious and inexplicable. One may feel a sudden wave of sadness and rake his brain for an explanation when he might have noticed that it was caused by a cloud cutting off the rays of the sun. He may see the image of a friend dear to him under conditions which he construes as very peculiar, when only shortly before he has passed him in the street or seen his photograph somewhere. When he loses a collar button he fusses and swears for an hour, being unable to visualize his previous actions and locate the object directly. Deficient observation is merely a form of ignorance and responsible for the many morbid notions and foolish ideas prevailing. There is not more than one out of every ten persons who does not believe in telepathy and other psychic manifestations, spiritualism and communion with the dead and who would refuse to listen to

Lack of
Observation
A Form of
Ignorance

willing or unwilling deceiver. Just to illustrate how deeply rooted this tendency has become even among the clear-headed Psychic Phenomena in the Manufacture of Flivvers. ^{Part} Shortly before the war, when the exhibition of my turbines in this City elicited widespread comment in the technical papers, I anticipated that there would be a ^{scramble} ~~scramble~~ among manufacturers to get hold of the invention and I had particular designs on that man from Detroit who has an uncanny faculty for accumulating millions. So ^{confident} ~~sure~~ was I that he would turn up some day, ~~that~~ ^{that} I declared this as certain to my secretary and assistants. Sure enough, one fine morning a body of engineers, ^{from} ~~representing~~ the Ford Motor Company presented themselves with the request of discussing with me an important project. "Didn't I tell you?" I remarked triumphantly to my employees, and one of them said, "You are wonderfully Mr. Tesla, everything comes out exactly as you predict." As soon as these ^{hard-headed} ~~distinguished~~ men were seated I, of course, immediately began to extol the wonderful features of my turbine when the spokesman interrupted me and said, "We know all about this but we are on a special errand. We ^{have} formed a psychological society for the investigation of psychic phenomena and we want you to join us in this undertaking." I suppose these engineers never knew how near they came to being fired out of my office.

CONFUTING SPIRITISM.

Ever since I was told by some of the greatest men of the time, leaders in science whose names are immortal, that I am possessed of an unusual mind, I bent all my thinking faculties on the solution of great problems regardless of sacrifice.

For many years I endeavored to solve the enigma of death and watched eagerly for every kind of spiritual indication. But only once in the course of my existence have I had an experience which, momentarily, impressed me as supernatural. It was at the time of my mother's death. I had become completely exhausted by pain and long vigilance and one night was carried to a building about two blocks from our home. As I lay helpless there, I thought that if my mother died while I was away from her bedside she would surely give me a sign. Two or three months before I was in London in company with my late friend, Sir William Crookes, when spiritualism was discussed and I was under the full sway of these thoughts. I might not have paid attention to other men but was susceptible to his arguments as it was his epochal work on radiant matter, which I had read as a student, that made me embrace the electrical career. I reflected that the conditions for a look into the beyond were most favorable, for my mother was a woman of genius and particularly excelling in the powers of intuition. During the whole night every fiber in my brain was strained in expectancy, but nothing happened ^{until} ~~early~~ early in the morning ^{when} I fell in a sleep or perhaps a swoon, and saw a cloud carrying angelic figures of marvelous beauty, one of whom gazed upon me lovingly and gradually assumed the features of my mother. The appearance slowly floated across the room and vanished and I was awakened by an indescribably sweet song of many voices. In that instant a certitude, which no words can express, came upon me that my mother had ^{just} died, and that was true. I ~~have never~~

was
^ unable to understand the tremendous weight of the painful knowledge
I received in advance and wrote a letter to Sir William Crookes
while still under the domination of these impressions and in poor
bodily health. When I recovered I sought for a long time the
external cause of this strange manifestation and, to my great re-
lief, I succeeded after many months of fruitless effort. I had
seen the painting of a celebrated artist, representing allegori-
cally one of the seasons in the form of a cloud with a group of
angels which seemed to actually float in the air, and this had
struck me forcefully. It was exactly the same that appeared in
my dream with the exception of my mother's likeness. The music
came from the choir in the church ^{nearby} at the early mass of Easter
morning, explaining everything satisfactorily in conformity with
scientific facts.

This occurred long ago and I have never had the
faintest reason since to change my views on psychical and spiritual
phenomena for which there is absolutely no foundation. The belief
in these is the natural outgrowth of intellectual development.
Religious dogmas are no longer accepted in their orthodox meaning
but every individual clings to some faith in a Supreme power of
some kind. We ^{all} must have ^{an} ideal to govern our conduct and insure
contentment but it is immaterial whether it be one of creed,
art, science or anything else, so long as it fulfills the function
of a dematerializing force. It is essential to the peaceful
existence of humanity as a whole that one common conception should
prevail.

Tesla's Astounding Discovery.

While I have failed to obtain any evidence in support

of the contentions of psychologists and spiritualists, I have proved to my complete satisfaction the automatism of life, not only through continuous observations of individual actions, but even more conclusively, through certain generalizations. These amount to a discovery which I consider of the greatest moment to human society and on which I shall briefly dwell. I got the first inkling of this astounding truth when I was still a very young man, but for many years I interpreted what I noted simply as coincidences. Namely, whenever either myself or a person to whom I was attached, or a cause to which I was devoted, was hurt by others in a particular way, which might be best popularly characterized as the most unfair imaginable, I experienced a singular and undefinable pain which, for want of a better term, I have qualified as "cosmic", and shortly thereafter, and invariably, those who had inflicted it came to grief. After many such cases I confided this to ^{a number of friends,} others who had the opportunity to convince themselves of the truth of the theory which I ^{have} gradually formulated and which may be stated in the following few words.

Our bodies are of similar construction and exposed to the same external influences. This results in likeness of response and concordance of the general activities on which all our social and other rules and laws are based. We are automata entirely controlled by the forces of the medium, being tossed about like corks on the surface of the water, but mistaking the resultant of the impulses from the outside for free will. The movements and other actions we perform are always life-preservative.

and though seemingly quite independent from one another, we are connected by invisible links. So long as the organism is in perfect order it responds accurately to the agents that prompt it, but the moment that there is some derangement in any individual, his self-preservative power is impaired. Everybody understands, of course, that if one becomes deaf, has his eyesight weakened, or his limbs injured, the chances for his continued existence are lessened. But this is also true, and perhaps more so, of certain defects in the brain which deprive the automaton, more or less, of that vital quality and cause it to rush into destruction. A very sensitive and observant being, with his highly developed mechanism all intact, and acting with precision in obedience to the changing conditions of the environment, is endowed with a transcending mechanical sense, enabling him to evade perils too subtle to be directly perceived. When he comes in contact with others whose controlling organs are radically faulty, that sense asserts itself and he feels the 'cosmic' pain. The truth of this has been borne out in hundreds of instances and I am inviting other students of nature to devote attention to this subject, believing that through combined and systematic effort results of incalculable value to the world will be attained.

Dr. Tesla's First Telautomaton.

The idea of constructing an automaton, to bear out my theory, presented itself to me early but I did not begin active work until 1893, when I started my wireless investigations. During the succeeding two or three years a number of automatic mechanisms,

to be ^{from a} ~~actuated~~ ^{distance}, were constructed by me and exhibited to visitors in my laboratory. In 1896, however, I designed a complete machine capable of a multitude of operations, but the consummation of my labors was delayed until late in 1897. This machine was illustrated and described in my article in the Century Magazine of June, 1900, and other periodicals of that time and, when first shown in the beginning of 1898, it created a sensation such as no other invention of mine has ever produced. In November, 1898, a basic patent on the novel art was granted to me, but only after the Examiner-in-Chief had come to New York and witnessed the performance, for what I claimed seemed unbelievable. I remember that when later I called on an official in Washington, with a view of offering the invention to the Government, he burst out in laughter upon my telling him what I had accomplished. Nobody thought then that there was the faintest prospect of perfecting such a device. It is unfortunate that in this patent, following the advice of my attorneys, I indicated the control as being effected through the medium of a single circuit and a well-known form of detector, for the reason that I had not yet secured protection on my methods and apparatus for individualization. As a matter of fact, my boats were controlled through the joint action of several circuits and interference of every kind was excluded. Most generally I employed receiving circuits in the form of loops, including condensers, because the discharges of my high tension transmitter ionized the air in the hall so that even a very small aerial would draw electricity from the surrounding atmosphere for hours. Just to give an idea, I found, for instance, that a bulb 12" in diameter, highly

exhausted, and with one single terminal to which a short wire was attached, would deliver well on to one thousand successive flashes before all charge of the air in the laboratory was neutralized. The loop form of receiver was not sensitive to such a disturbance and it is curious to note that it is becoming popular at this late date. In reality it collects much less energy than the serials or a long grounded wire, but it so happens that it does away with a number of defects inherent to the present wireless devices. In demonstrating my invention before audiences, the visitors were requested to ask any questions, however involved, and the automaton would answer them by signs. This was considered magic at that time but was extremely simple, for it was myself who gave the replies by means of the device.

At the same period another larger telautomatic boat was constructed, a photograph of which is shown in this number of the Electrical Experimenter. It was controlled by loops having several turns placed in the hull, which was made entirely water-tight and capable of submergence. The apparatus was similar to that used in the first with the exception of certain special features I introduced as, for example, incandescent lamps which afforded a visible evidence of the proper functioning of the machine and served for other purposes.

TELAUTOMATICS of the FUTURE.

These automata, controlled within the range of vision of the operator, were, however, the first and rather crude steps in the evolution of the Art of Telautomatics as I had conceived it. The next logical improvement was its application to automatic mechanisms beyond the limits of vision and at great distance from the

center of control, and I have ever since advocated their employment as instruments of warfare in preference to guns. The importance of this now seems to be recognized, if I am to judge from casual announcements through the press of achievements which are said to be extraordinary but contain no merit of novelty whatever. In an imperfect manner it is practicable, with the existing wireless plants, to launch an aeroplane, have it follow a certain approximate course, and perform some operation at a distance of many hundreds of miles. A machine of this kind can also be mechanically controlled in several ways and I have no doubt that it may prove of some usefulness in war. But there are, to my best knowledge, no instrumentalities in existence today with which such an object could be accomplished in a precise manner. I have devoted years of study to this matter and have evolved means, making such and greater wonders easily realizable. As stated on a previous occasion, when I was a student at college I conceived a flying machine quite unlike the present ones. The underlying principle was sound but could not be carried into practice for want of a prime-mover of sufficiently great activity. In recent years I have successfully solved this problem and am now planning aerial machines devoid of sustaining planes, ailerons, propellers and other external attachments, which will be capable of immense speeds and are very likely to furnish powerful arguments for peace in the near future. Such a machine, sustained and propelled entirely by reaction, is shown on one of the pages and is supposed to be controlled either

mechanically or by wireless energy. By installing proper plants it will be practicable to project a missile of this kind into the air and drop it almost on the very spot designated which may be thousands of miles away. But we are not going to stop at this. Telautomats will be ultimately produced, capable of acting as if possessed of their own intelligence and their advent will create a revolution. As early as 1898 I proposed to representatives of a large manufacturing concern the construction and public exhibition of an automobile carriage which, left to itself, would perform a great variety of operations involving something akin to judgment. But my proposal was deemed chimerical at that time and nothing came from it.

At present many of the ablest minds are trying to devise expedients for preventing a repetition of the awful conflict which is only theoretically ended and the duration and main issues of which I have ^{correctly} predicted in an article printed in the Sun of December 20, 1914. The proposed League is not a remedy but, on the contrary, in the opinion of a number of competent men, may bring about results just the opposite. It is particularly regrettable that a punitive policy was adopted in framing the terms of peace, ^{because} ~~xxx~~ a few years hence it will be possible for nations to fight without armies, ships or guns, by weapons far more terrible, to the destructive action and range of which there is virtually no limit. Any city, at a distance, whatsoever, from the enemy, can be destroyed by him and no power on earth can stop him from doing so. If we want to avert an

impending calamity and a state of things which may transform this globe into an inferno, we should push the development of flying machines and wireless transmission of energy without an instant's delay and with all the power and resources of the nation.

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Spec Ms Coll Tesla

Tesla, Nikola
The New Tesla Electric Heater
n.p., n.d.
a.ms., 3 p. (possibly in Tesla's hand)
With typed copy and carbon.

21380E

THE NEW TESLA ELECTRIC HEATER.

STRICTLY CONFIDENTIAL

This device is greatly superior to the usual flat coil type in efficiency and other respects. It consists of a thin polished metal tube acting as reflector and a base equipped with switch and connecting terminals and carrying spaced resistor wires concentric with the tube and at a certain distance from the inner surface of the same. In this arrangement the diffuse radiation is virtually eliminated and the heater operates as if the resistor were not present, the rays being projected from the reflector radially to the central or focal region occupied by the boiling pot.

The principal advantages thus secured are the following:

1. A very high efficiency, as much as 96% being attainable.
2. The efficiency is practically the same whether the pot be large or small since the density of the rays is inversely as the diameter of the vessel.
3. Due to these features the current consumption

is hardly more than half of that in the best heaters of the type referred to.

4. The resistor has a relatively much longer life and can be made to last almost indefinitely in some cases. Also less wire can be used if desired.

5. The heat being largely confined to the range, the kitchen remains comparatively cool.

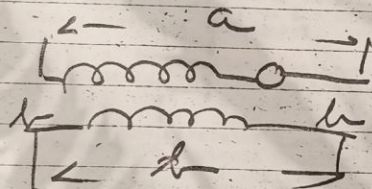
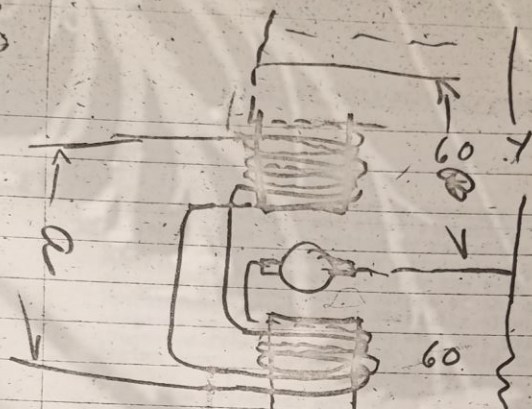
6. Another practical advantage is greater safety from a variety of accidents frequently occurring with ordinary ranges.

7. The new heater is especially adapted for use on shipboard, Pullman cars, aerial vehicles and automobiles.

8. Likewise, it is suitable for all kinds of service on the table, being free from the objections of the present heaters.

9. It saves considerable time in certain applications.

10. Owing to simplicity the cost of manufacture is low.



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Wind field coils with two wires - winding both at the same time. One set of field windings to be connected in series, see circuit A, and two terminals also brought out. The other set of field windings should be connected in series with the armature, see circuit B. Each circuit to take 1/20 ampere or 60 volts.

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Tesla, Nikola
The rocket in the next war? by David Lasser
n.p., [March 1932]
a.ms., 1p. (comment written by N. Tesla above
title of article in Everyday Science and Mechanics,
March 1932, p. 326-328.)

21380E

I have this idea years ago and it will be carried out in a much simpler way than here described.

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EVERYDAY SCIENCE AND MECHANICS

March, 1932

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•The ROCKET in the

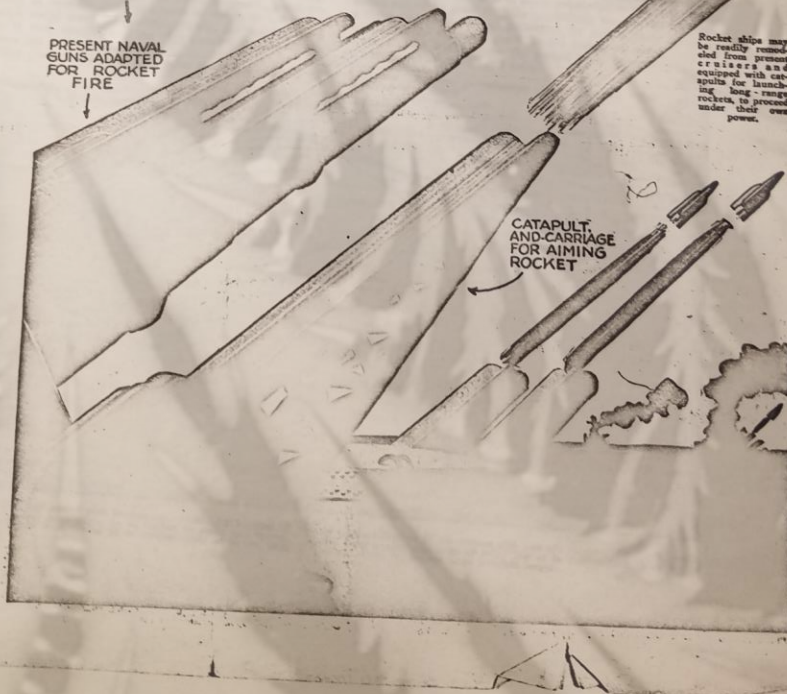
The problem of making war effective has become that of destruction from the greatest distance. The rocket stands out as the most far-reaching potentiality for attack on a distant foe.

THE whole nation will find itself on the firing line," said Marshal Foch, looking forward to "the next war." To fleets, consider the question of scientific militarists. Assume that two nations are at war and their armies have been rushed to the frontier. The strategy of the new warfare will call for the prevention of an enemy invasion and, simultaneously, the destruction of the enemy's strategic centers by long-range shells.

Consider what this means. Long-range artillery, which previously has been used principally against opposing armies, at distances of five to twenty-five miles, must now be adapted to shoot shells 200 to 300 miles. It will be necessary, furthermore, to hit the distant targets aimed at, and to hit them often enough to complete the desired destruction. For this novel task, in my opinion, present artillery is entirely unfit and, were the success of future long-range bombardment to rest solely on the artillery, one arm of the "destruction from a distance" program would surely fail. But luckily for the militarist, the rocket will supply him with the very instrumentality that he needs.

It is quite possible that, even were long-range guns constructed like mountains of steel, to withstand all the enormous strains of firing, and to give greatly increased velocities to the shells, they would yet fail to achieve the necessary ranges. For the enormous increase in the resistance of the air, at these great velocities, would reduce the speed of the shells so quickly as to minimize the effect of the added propulsive force. The additional energy imparted to a shell, to increase its muzzle velocity, might serve only to heat the casing by friction against the air, and add but little to its actual range.

This fundamental weakness of the present high-power artillery is in contrast with the effectiveness of the rocket-propelled shell as a means of effecting a long-distance bombardment. For the rocket can, first, propel shells to distances impossible with artillery; and, secondly, could be shot in such numbers and with such rapidity as to constitute an avalanche of death from which there would be no escape.



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WAR ?

By DAVID LASSER*

passage, the rocket shell would then drop with terrifying speed upon city or munition plant.

War to the Utmost

WHAT would this mean in an actual conflict? Scanning the map of Europe, we see that Paris could easily be shelled from the German border, and Berlin from the Rhine. London would be within range of both French and German shells; and little Switzerland, now a buffer state against the progress of opposing armies, might find itself arched by a rain of Italian and French rocket shells, hurled into enemy territory.

Each nation could devastate the other in a rain of death, from which there could be no relief. All of the creative and destructive facilities of man could be destroyed without a foot being set across an enemy border.

Let us imagine the effect of the rocket upon America, in its supposed isolation. An enemy fleet may start upon the invasion of America equipped with rocket batteries that shoot shells 200 miles or more. This is possible, since no heavy ordnance need be carried to shoot them. The fleet could anchor off our coast and reduce our forts to a mass of ruins. Our sixteen-inch coast-defense guns, with maximum ranges of 30 miles, would be toys, compared to the naval rocket batteries.

Boston, New York, Philadelphia, Baltimore and Washington could be reduced by an enemy fleet resting in safety in the Atlantic; or our Pacific ports might fall without a serious blow being struck.

For emphasis I record an editorial of the *New York Times*, of October 10, 1931, commenting upon the perfection of anti-aircraft guns. "What was to happen in the next war," said the *Times*, "has been described in terms calculated to frighten every nation out of its growth, if the predictions were taken without a thought of the means of protection. In such a vast convulsion the airplane would be the means of destruction. If a defense from the ground could be contrived countries would feel safer."

*President, American Interplanetary Society; author, "The Conquest of Space."

The rocket flies, gaining headway at each instant, under gyroscopic or other control of flight, until it passes into a practically airless region; and finally descends hundreds of miles away.

The Rocket's Principle

IN simplest terms, the rocket consists of a chamber in which a fuel is burned (See Fig. 1) and the resultant expanding gases are expelled to the outside. The expansion and expulsion of the highly compressed gases causes a reaction or "kick" against the chamber walls that pushes the rocket ahead. This action is similar to the recoil of firearms; the "kick" of the weapon being the reaction to the force of expulsion of the shell.

The rocket carries its own fuel; and its motion continues until the fuel has been exhausted and the momentum lost.

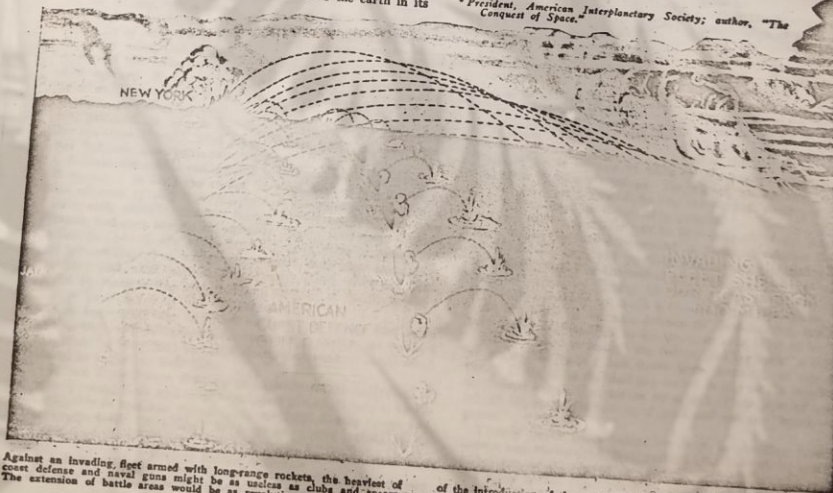
If, to the rocket motor, there is attached a nose filled with high explosive, gas or anything deadly that modern science can create, there is created a self-propelling shell that should make possible the fondest dreams of the militarist.

Such projectiles would be gun and shell in one and, therefore, no heavy ordnance would be necessary to shoot them. It would merely be necessary to give them a start, and they would carry themselves hundreds of miles, to strike with stunning force.

Batteries, shooting rocket shells into the heart of an enemy country, could be built by the thousands, and fired with the rapidity of small calibre artillery.

The rocket, in fact, would travel through the air, in a manner just the opposite of that of an artillery shell. Where the long-range artillery shell leaves the gun at its maximum speed, encountering at once the great resistance of the lower air levels; the rocket would leave the mounting slowly, and acquire speed only as it shot upward into the high rarefied regions of the air, where the resistance is small.

Shooting upward, thirty to fifty miles above the earth in its



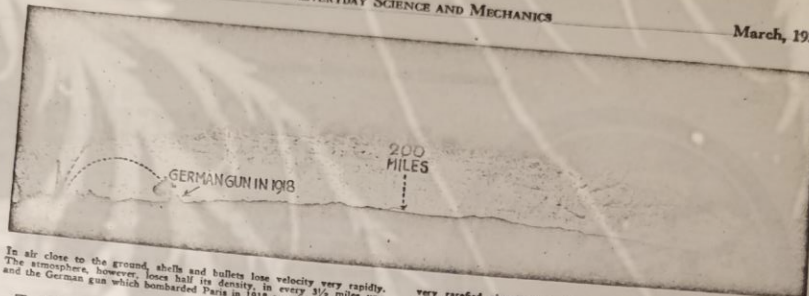
Against an invading fleet armed with long-range rockets, the heaviest of coast defense and naval guns might be as useless as clubs and spears. The extension of battle areas would be as revolutionary as in the days

of the introduction of the modern rifle and the airplane. Assaults would be directed upon known objectives, by ship just as in long-range artillery fire of today, which is directed upon invisible targets.

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In air close to the ground, shells and bullets lose velocity very rapidly. The atmosphere, however, loses half its density, in every $3\frac{1}{2}$ miles up; and the German gun which bombarded Paris in 1918 sent its shells through

The *Times* writer, wisely, did not consider the possibility of long-distance artillery shells becoming the means of destruction; for the limitation of their range was assumed. But, against the rocket shell, whose range for warfare is practically limitless, there is no defense or safety.

The Rocket Plane

FOR full effectiveness, air raids must come as surprises and be executed swiftly. The attacks on London and Paris, during the World War, usually failed to surprise. Sound detectors and scouting planes gave warning of the coming of the anti-aircraft guns and defending planes helped to hinder their activities.

The present-day airplane must fly in the relatively lower levels of the air; its approach can thus be detected and the sound of its motors gives warning; and, because it is also at the mercy of the elements, it will, in my opinion, fail to effect the purpose of future air raids.

What would be desired is a plane that can sweep across enemy country so high that it cannot be detected, and so swiftly that little warning can be given of its coming. If a plane could be developed that could fly at altitudes of ten to thirty miles, and achieve speeds of 1000 miles an hour and upward, it would be practically invincible. Such a plane, propelled by rockets, promises to appear in the not distant future. (See the November, 1931, issue of *EVERYDAY SCIENCE AND MECHANICS*, page 448.)

Because the rocket can operate in thin air, where the airplane is useless (in fact, the rocket develops its greatest power in the absence of air) rocket-propelled planes can ascend to a thirty-mile altitude, or even higher, out of reach of opposing planes, and even beyond all visibility. Flying at a speed of 8000 miles an hour in the upper layers (where there is practically no air resistance) a rocket plane could flash over the enemy country and, with motors off, swoop suddenly from the skies upon an unsuspecting city. Losing its load of death, it could escape just as swiftly into the heavens.

One hour after war had been declared, an enemy fleet from across the ocean could bomb our coast cities. Before we realized away, to return to their base.

If one nation were thus equipped with rocket batteries, or with a rocket fleet and rocket-equipped planes, it might be invulnerable in warfare. Speed, dash, mobility, deadly range and accuracy would be utilized to force an enemy nation to its knees.

Present Rocket Activities

ALTHOUGH this discussion of the use of the rocket may seem fanciful, it is based upon what can be developed

very rarefied air most of the way. The rocket shell, going 500 miles, would travel practically in a vacuum. Its highest speed is developed where the resistance is least, in contrast to the projectiles from a gun.

from an established principle. Experimental rockets have been projected, in the last year, to distances of three to five miles and heights of six miles. Toy models, they developed considerable power and have encouraged experimenters throughout the world to continue to tame the giant that slumbers in the rocket.

The full development of the rocket awaits only the mastering of the best construction, and the control of its flight through the air. The late Daniel Guggenheim was so impressed with the rocket's possibilities, that he donated \$100,000 to support the experiments of Dr. Robert H. Goddard, an American physicist. Working in New Mexico, Dr. Goddard is perfecting an instrument to solve some of the secrets of our upper atmosphere and become a valuable aid to aviation.

Only recently did he obtain the patenting of a rocket airplane; and in the *New York Times*, of September 27, he stated his belief that the rocket plane can fly at upward of 1000 miles an hour in rarefied air. In Germany, Italy, France and Russia,

rocket experimenters are exploring the rocket's peace time potentialities, with a view to building rocket planes.

That the tremendous war possibilities of these discoveries are becoming known to militarists, is not to be doubted. Professor Hermann Oberth, the noted Austrian rocket experimenter, speaking before a scientific group in Vienna, stated recently his belief that the war office of every

large nation is already at work on the rocket, adapting it to the needs of future warfare. He warned his audience that the world must be prepared to see the rocket developed to the fullest extent of its destructive powers.

These facts are unpleasant to face—especially for those who hope to see the rocket harnessed to peaceful vehicles that will annihilate distance, and possibly achieve the exploration of interstellar space. For the rocket possesses vast powers to affect our civilization, by linking all parts of the earth and making the longest journey on earth a trip of but a few hours.

As the basis of the new science of *Astronautics*, the rocket may make possible trips to the moon, or even Mars or Venus.

But whether the man of the future, looking back to 1931, will wish that the rocket had never been invented, no one knows today. It seems to me that the rocket is one of the creations of the human mind, that serves as a test of our species' right to inherit the earth. Its powers of good and evil are "equal and opposite."

Twenty years from today, we may be shooting across our oceans and national borders, rockets that hold either articles of commerce, or missiles of destruction. Which it will be, depends, not upon rocket experimenters, nor upon militarists but upon the people of the world who will have to pay for, fight, and suffer all warfare.

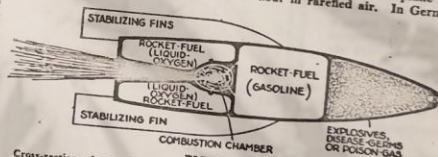


FIG. 1
Cross-section of a rocket, of the type on which experiments are being made, with an aim toward stratosphere (upper atmosphere) and, later, interplanetary flight. The larger portion of its bulk is fuel: liquid oxygen and gasoline giving a very high pressure, and consequently, high velocity of propulsion. The fins keep the rocket on its course.

Familiar Objects.

McKAY, F.R.P.S.

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When we speak of light we usually think of what we ordinarily call white light, but this is really a mixture of all the wavelengths lying between the two limits of visibility. If we isolate a single wavelength, we find that we have a color whose hue depends upon the length of the wave. The longest waves which we can see are the red, while the shortest are violet; and between these two we have

an angle upon such a transparent substance, its path is bent. A stick thrust into clear water appears to be sharply bent at the surface of the water; this fact is familiar to all of us. However, when a ray of light is bent in this manner, the violet or short waves are bent more sharply than the red. If a piece of glass is triangular in

shape, so that a narrow beam of light falling upon it is bent sharply both upon entering and leaving it, the light emerging is separated into the various colors; and the spectrum is made visible upon any light-colored surface upon which the broken beam falls.

The phenomenon of bending



Crystals of sulphate of quinine, photographed through a compound microscope to which the polarizing prisms had been attached. The colors of this specimen range from deep red, through orange and brown, to peacock blue and vivid green.

and toward which we are headed.

Polarization

THERE are many natural crystalline substances which refract light in a most peculiar manner. These substances break a ray of light into two parts, one of which is refracted more strongly than the other; the two rays are known as the *ordinary* ray and the *extraordinary* ray. An optical crystal of this nature is Iceland Spar. If we lay a transparent crystal of Iceland Spar upon a printed design,

(Continued on page 378)

Here is an object which could successfully defy definite identification from the most expert mineralogist; under the microscope one sees a pattern of glorious color, moving clouds. It is a tiny portion from a paper-thin section of a fragment of Cleopatra's Needle, the famous obelisk which journeyed from the Nile Valley to London, while its mate came to New York.

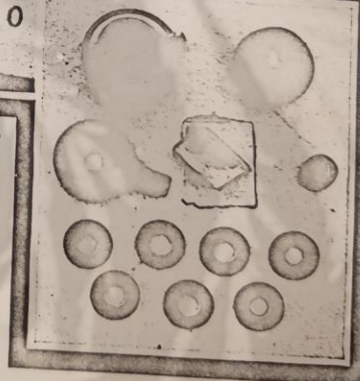
that brilliant band of color known familiarly to us as "rainbow colors," and known in the laboratory as the *spectrum*. The spectrum is not only beautiful but intensely interesting and is itself of the utmost importance in scientific investigation. But, before we can fully understand how it may be made visible we must understand a peculiar property of light waves.

Refraction and Dispersion

WE know that there are a number of substances through which light will pass; we call these substances transparent. All these transparent substances offer some resistance to the passage of light; so that, although the speed of light in air is practically one hundred and eighty-six thousand miles per second, it is appreciably slower through these transparent substances. When the light ray falls at

Certain crystals possess the property of splitting light rays into two parts. Iceland Spar is such a crystal; as clearly shown in this photograph of a monogram upon which has been laid a crystal of this kind. This shows graphically the principle shown in the accompanying diagrams.

a ray of light in this manner is called *refraction*; while the separation of the beam into these various colors is called *dispersion*. Refraction is the basis upon which all optical science is built, and without which all optical instruments would be impossible. Dispersion is widely used in the most valuable researches in physics, chemistry and astronomy. It is indeed a temptation to stray aside into the fields of interest opened by these two subjects, but there is another which lies beyond



Above is illustrated complete apparatus for converting the ordinary compound microscope into a polarizing model: upper left, analyzer with its calibrated circle, which fits over the eyepiece of the microscope; upper right, polarizer, through which the light passes before it passes into the microscope. Center left, the "pan," containing a mica control plate; center, a crystal of Iceland Spar showing double refraction; center right, a Nicol prism in a simple cork mount. This last is made from Iceland Spar and is the vital element of both polarizer and analyzer. At the bottom are shown seven control plates, which retard the light ray to a definite degree.

COLUMBIA UNIVERSITY LIBRARIES
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Spec Ms Coll Tesla

Tesla, Nikola
Seventh Chapter
n.p., n.d.
t.ms., 3 p. (p. 73-75 of a novel or biography?)

21380E

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22

Seventh Chapter.

What my uncle Herse said and what my ~~uncle~~ Herse was; and why Fritz Sahlmann had to whistle.

When the watchmaker was taken down the castle hill, Fritz Sahlmann had, of course, gone along, only in order to see how the thing became the prisoner and if he would not perhaps escape, but the latter did not come to pass. The procession moved slowly down to the town-hall, for it had to wind its way troublesomely through all sorts of teams and wagons, which had been commanded from the villages and the town for the transportation of baggage and booty and were now drifting together in the castle-court and on the road to the castle and surrounded by Frenchmen, that they might not again escape, for the old farmers were already devilish smart ^{at} this ~~game~~ ^{game}. - The watchmaker went along with his two guardians, patient as a lamb and also perfectly calm, for though he had been greatly frightened at first and although the whole affair of last night was very disagreeable and serious for him, during the examination which the adjutant had instituted with him he had come into a frame of mind, which might be described as: "Yes, you talk on! You may say a great deal before a word of it will please me", and his answers had turned out very chary. And although he had not in him that wild courage which immediately goes for everything, he had already been too long in the world and been in a scrape so often, that he did not immediately despair. He let things come as

they may. "I wonder how this is going to ~~end~~?" he said to himself, when he was pushed into the door of the town-hall. -

"Fritz Sahlmann", said ~~alderman~~ Herse to the boy, when he wanted to go up to the castle again, "what does this mean?" - Fritz Sahlmann tells with the greatest importance the story of yesterday, and that Mr. Droi had slept in Mamselle Westphalian's room and had broken up everything and how he himself had dropped and broken the chief-magistrate's pipe, -but he could not help it, it was Fiken's fault- and that the colonel had wanted to stab the chief magistrate and how Mamselle Westphalian was sitting in the kitchen, a picture of despair; but about the lump of ice he said nothing.

Now my uncle, ~~alderman~~ Herse, was immensely patriotic, even if only in secret. And that had its reason. For as he whispered to me long years afterward, when Bonaparte was already dead, he used to belong at this time to the League of Virtue. And I do believe him, because when he was in company he would always play with a long watch chain of very light hair - and aunt Herse's was black - and he would always show a dangerously big iron ~~king~~ finger ring, with which he had one time almost beaten that vagabond Huepner, a journeyman locksmith, to death, when he had behaved in a very impolite manner in the court room. - "Fritz", he said to me later, "this hair is from a heroic maiden, who anno thirteen had

her head shorn for the fatherland, and this iron ring has cost me my gold one. But do not speak of it, I do not like it." Therefore he was at the time when this story happened, with good reason much for secrecy. It is possible, too, that his way and manner of looking over everything together from a distant point of view had much to do with his leaning towards secrecy, for while my father had to harass himself day and night with the most trifling drudgery and toil, in order that the little old needy community might barely remain hanging together and would not go to pieces ~~altogether~~ entirely, ^{alderman} Herse would let Kutosow march to the right and Czernitchew to the left, praise York and scold about Buelow, he did not understand his business, for he should not have moved to Berlin, but to the right as far as Stenhausen and rushed into Bonaparte's flank. In short, he was just the right sort of a man to turn a sneeze into a thunderclap: in every innocent French corporal he saw a Corsican tyrant, and if on some blue Monday at a workmen's row constable Luth had received a few blows too, then he would carry on, as if the Duke of Mecklenburg had been treated to a slap in the face.

"Hold your tongue, boy!" ^{alderman} Herse whispered very seriously, "do you want to cry out your death sentence here in the public market place? - For the watchmaker's life I would not give a single groschen, because it is certain that the miller and his Frederick have killed the chasseur ..." - "Not the miller", Fritz'

COLUMBIA UNIVERSITY LIBRARIES
Special Collections
Spec Ms Coll Tesla

Tesla, Nikola
n.p., after 1936
t.ms., 10 pp.
(Some biographical information, but
mainly on his various discoveries)

213808



Apr 1956

At the close of 1899, having worked one year in the shops of George Westinghouse, Pittsburgh, I experienced so great a longing for resuming my interrupted investigations that, notwithstanding a very tempting proposition by him, I left for New York to take up my laboratory work. But owing to pressing demands by several foreign scientific societies I made a trip to Europe where I lectured before the Institution of Electrical Engineers and Royal Institution in London and the Societe de Physique in Paris. After this and a brief visit to my home in Yugoslavia I returned to this country in 1902 eager to devote myself to the subject of predilection of my thoughts: the study of the universe.

During the succeeding two years of intense concentration I was fortunate enough to make two far-reaching discoveries. The first was a dynamic theory of gravity, which I have worked out in all details and hope to give to the world very soon. It explains the causes of this force and the motions of heavenly bodies under its influence so satisfactorily that it will put an end to idle speculations and false conceptions, as that of curved space. According to the relativists, space has a tendency to curvature owing to an inherent property or presence of celestial bodies. Granting a semblance of reality to this fantastic idea, it is still self-contradictory. Every action is accompanied by an equivalent reaction and the effects of the latter are directly opposite to those of the former.



- 2 -

Supposing that the bodies act upon the surrounding space causing curvatures of the same, it appears to my simple mind that the curved spaces must react on the bodies and, producing the opposite effects, straighten out the curves. Since action and reaction are co-existent, it follows that the supposed curvature of space is entirely impossible. But even if it existed it would not explain the motions of the bodies as observed. Only the existence of a field of force can account for them and its assumption dispenses with space curvature. All literature on this subject is futile and destined to oblivion. So are also all attempts to explain the workings of the universe without recognizing the existence of the ether and the indispensable function it plays in the phenomena.

My second discovery was a physical truth of the greatest importance. As I have searched the scientific records in more than a half dozen languages for a long time without finding the least anticipation, I consider myself the original discoverer of this truth, which can be expressed by the statement: There is no energy in matter other than that received from the environment. On my 75th birthday I made a brief reference to it, but its meaning and significance have become clearer to me since then. It applies rigorously to molecules and atoms as well as to the largest heavenly bodies, and to all matter in the universe in any phase of its existence from its very formation to its ultimate disintegration.



- 3 -

Being perfectly satisfied that all energy in matter is drawn from the environment, it was quite natural that when radioactivity was discovered in 1896 I immediately started a search for the external agent which caused it. The existence of radioactivity was positive proof of the existence of external rays. I had previously investigated various terrestrial disturbances affecting wireless circuits but none of them or any others emanating from the earth could produce a steady sustained action and I was driven to the conclusion that the activating rays were of cosmic origin. This fact I announced in my papers on Roentgen rays and Radiations contributed to the Electrical Review of New York, in 1897. However, as radioactivity was observed equally well in other widely separated parts of the world, it was obvious that the rays must be impinging on the earth from all directions. Now, of all bodies in the Cosmos, our sun was most likely to furnish a clue as to their origin and character. Before the electron theory was advanced, I had established that radioactive rays consisted of particles of primary matter not further decomposable, and the first question to answer was whether the sun is charged to a sufficiently high potential to project such particles and produce the effects noted. This called for a prolonged investigation which culminated in my finding that the sun's potential was 216 billions of volts and that all such large and hot heavenly bodies emit cosmic rays. Through



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further solar research and observation of Novae this has been proved conclusively, and to deny it would be like denying the light and heat of the suns. Nevertheless, there are still some doubters who prefer to shroud the cosmic rays in deep mystery. One of them declared recently that they must come from very remote regions in which matter is converted into energy. I am sure that this is not true for there is no place where such a process occurs in this or any other universe beyond our ken.

A few words will be sufficient in support of this contention. The kinetic and potential energy of a body is the result of motion and determined by the product of its mass and the square of velocity. Let the mass be reduced, the energy is diminished in the same proportion. If it be reduced to zero the energy is likewise zero for any finite velocity. In other words, it is absolutely impossible to convert mass into energy. It would be different if there were forces in nature capable of imparting to a mass infinite velocity. Then the product of zero mass with the square of infinite velocity would represent infinite energy. But we know that there are no such forces and the idea that mass is convertible into energy is rank nonsense.

While the origin and character of the rays observed near the earth's surface are sufficiently well ascertained, the so-called cosmic rays observed at great altitudes presented




- 5 -

a riddle for more than 26 years, chiefly because it was found that they increased with altitude at a rapid rate. My investigations have brought out the astonishing fact that the effects at high altitudes are of an entirely different nature, having no relation whatever to cosmic rays. These are particles of matter projected from celestial bodies at very high temperature and charged to enormous electric potentials. The effects at great elevations, on the other hand, are due to waves of extremely small lengths produced by the sun in a certain region of the atmosphere. This is the discovery which I wish to make known. The process involved in the generation of the waves is the following: The sun projects charged particles constituting an electric current which passes through a conducting stratum of the atmosphere approximately 10 kilometers thick enveloping the earth. That is a transmission of energy exactly as I illustrated in my experimental lectures in which one end of a wire is connected to an electric generator of high potential, its other end being free. In this case the generator is represented by the sun and the wire by the conducting air. The passage of the solar current involves the transference of electric charges from particle to particle with the speed of light, this resulting in the production of extremely short and



- 6 -

penetrating waves. As the air stratum mentioned is the source of the waves it follows that the so-called cosmic rays observed at great altitudes must increase as this stratum is approached. My researches and calculations have brought to light the following facts in this connection: (1) the intensity of the so-called cosmic rays must be greatest in the zenithal portion of the atmosphere; (2) the intensity should increase more and more rapidly up to an elevation of about 30 kilometers where the conducting air stratum begins; (3) from there on the intensity should fall, first slowly and then more rapidly, to an insignificant value at an altitude of about 30 kilometers; (4) the display of high potential must occur on the free end of the terrestrial wire, that is to say, on the side turned away from the sun. The current from the latter is supplied at a pressure of about 216 billion volts and there is a difference of 2 billion volts between the illuminated and the dark side of the globe. The energy of this current is so great that it readily accounts for the aurora and other phenomena observed in the atmosphere and at the earth's surface. 

For the time being I must content myself with the announcement of the salient facts, but in due course I expect to be able to give more or less accurate technical



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data relating to all particulars of this discovery.

To go to another subject, I have devoted much of my time during the year past to the perfecting of a new small and compact apparatus by which energy in considerable amounts can now be flashed through interstellar space to any distance without the slightest dispersion. I had in mind to confer with my friend George E. Hale, the great astronomer and solar expert, regarding the possible use of this invention in connection with his own researches. In the meantime, however, I am expecting to put before the Institute of France an accurate description of the device with data and calculations and claim the Pierre Gammou Prize of 100,000 francs for means of communication with other worlds, feeling perfectly sure that it will be awarded to me. The money, of course, is a trifling consideration, but for the great historical honor of being the first to achieve this miracle I would be almost willing to give my life.

My most important invention from a practical point of view is a new form of tube with apparatus for its operation. In 1896 I brought out a high potential targetless tube which I operated successfully with potentials up to 4 million volts from '93 to '99. This device was adopted by many imitators



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and with slight modifications it is employed even now in all research laboratories and scientific institutions here and in other countries, and virtually all atomic investigations are carried on with it. At a later period I managed to produce very much higher potentials up to 18 million volts, and then I encountered unsurmountable difficulties which convinced me that it was necessary to invent an entirely different form of tube in order to carry out successfully certain ideas I had conceived. This task I found far more difficult than I had expected, not so much in the construction as in the operation of the tube. For many years I was baffled in my efforts, although I made a steady slow progress. Finally though, I was rewarded with complete success and I produced a tube which it will be hard to improve further. It is of ideal simplicity, not subject to wear and can be operated at any potential, however high, that can be produced. It will carry heavy currents, transform any amount of energy within practical limits, and it permits easy control and regulation of the same. I expect that this invention, when it becomes known, will be universally adopted in preference to other forms of tubes, and that it will be the means of obtaining results undreamed of before. Among others, it will enable the production of cheap radium substitutes in any desired quantity and will be, in general, immensely more effective in the quenching of



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atoms and the transmutation of matter. I am hopeful that it will be possible by its use to carry out a process in which there should be no misses whatever, but only hits. However, this tube will not open up a way to utilize atomic or sub-atomic energy for power purposes. According to the physical truth I have discovered there is no available energy in atomic structures, and even if there were any, the input will always greatly exceed the output, precluding profitable, practical use of the liberated energy.

Some papers have reported that I had promised to give a full description of my tube and its accessories on the present occasion. This has caused no considerable annoyance, as, owing to some obligations I have undertaken regarding the application of the tube for important purposes, I am unable to make a complete disclosure now. But as soon as I am relieved of these obligations a technical description of the device and of all the apparatus will be given to scientific institutions.

There is one more discovery which I want to announce at this time, consisting of a new method and apparatus for the obtaining of vacua exceeding many times the highest heretofore realized. I think that as much as one-billionth of a micron can be attained. What may be accomplished by means of such vacua is a matter of conjecture, but it is obvious that they will make possible the production of much more intense



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effects in electron tubes. My ideas regarding the electron are at variance with those generally entertained. I hold that it is a relatively large body carrying a surface charge and not an elementary unit. When such an electron leaves an electrode of extremely high potential and in very high vacuum it carries an electrostatic charge many times greater than the normal. This may astonish some of those who think that the particle has the same charge in the tube and outside of it in the air. A beautiful and instructive experiment has been contrived by me showing that such is not the case, for as soon as the particle gets out into the atmosphere it becomes a blazing star owing to the escape of the excess charge. The great quantity of electricity stored on the particle is responsible for the difficulties encountered in the operation of certain tubes and the rapid deterioration of the same.

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Tesla, Nikola
n.p., 15 Apr 1932
a.ms.s. (with initials), 2 p. (Statement of
Tesla relating to force and matter, to
Einstein's theories, and Tesla's own
theory of gravitation)

21380Z

the subject you wish to write
about. In order to explain this
phenomenon Einstein has
invented the quantum "lantern".

My theory of gravitation
explains this phenomenon
perfectly.

23
158
N.T. April 16, 1932.
We read a great deal about the
conversion of matter being
changed into force and force
being changed into matter
by the cosmic rays. This is
absurd. It is the same as
saying that the body can be
changed into the mind, and the
mind into the body. We know
that the mind is a functioning
of the body, and in the same
manner force is a function of
matter. Without a body there
can be no mind, without matter
there can be no force.

Einstein has for years developed
formulas explaining the mechanism
of the cosmos. In doing this he
overlooked an important factor,
namely the fact, namely that some
of the heavenly bodies are increasing
in distance from the sun. This
is the same as writing for a
business letter and forgetting

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Spec Ms Coll Tesla

Tesla, Nikola
Talking by wireless, by Alfred Gradenwitz
n.p., n.d.
a.ms., 3p. (comments written by Tesla on 3 pages of
article in The Technical World Magazine, p. 203-206, n.d.)

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*Only five inventions of mine
are used in this. These
people are not logs.*
Talking by Wireless

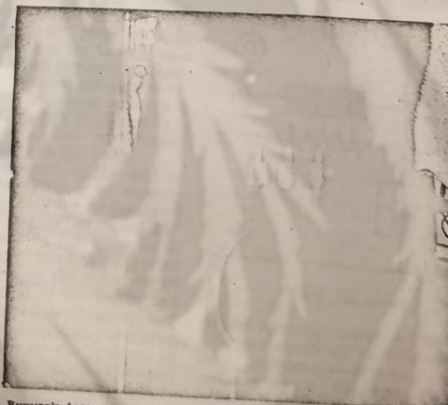
By Dr. Alfred Gradenwitz



O the casual observer it would seem that it is only a question of months until the wireless telephone will supplant the present systems of telephony as a means of communication. In fact, scarcely a month passes in which important steps are not taken toward the goal of practical wireless telephony. But the difficulties to be overcome are enormous. Some idea of these difficulties and the methods by which they are being surmounted may be gained from recent developments along this line.

Some investigations of considerable importance in the field of wireless telephony were commenced a few years ago by Mr. E. Ruhmer of Berlin, who developed a rather promising system in which the light waves given out from an arc lamp projector were used as a medium in transmitting the human voice from one station to another. At the starting point was installed a very sensitive telephone transmitter in circuit with a battery and the primary terminals of an induction coil, whose secondary terminals were connected through condensers to the terminals of an arc lamp supplied from a direct current generator. When words were spoken into the transmitter varying currents were induced in the secondary of the coil, changing the current on the lamp, and thus varying the intensity of its light. This also produced sounds of vary-

ing intensity and pitch, and constituted what is known as a "speaking" or "singing" arc. As the arc light was situated in the focus of a powerful projector these changes in illumination were projected as far as the receiving station, where a similar projector was installed containing in its focus a selenium resistance—or selenium cell, as it is called. Selenium is a substance possessing the very remarkable property of varying its electrical conductivity under the action of light. When this cell is in a circuit through which a current is passing the variations in resistance of the selenium cell due to the actions of the rays of light will cause changes in current intensity in the circuit. As the latter in the present case contained a telephone, it will be readily understood that similar fluctuations in current intensity to those taking place in the transmitting circuit were pro-



RUHMER'S APPARATUS FOR PHOTOGRAPHING THE FORM OF ETHER WAVES DURING TRANSMISSION OF SPEECH, BY RAYS OF LIGHT.
A diagram of this arrangement is shown in Figure 1.

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Talking by wi
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THE TECHNICAL WORLD MAGAZINE

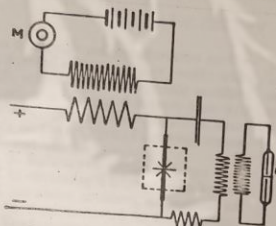


FIG. 1. RUHMER'S EXPERIMENTAL APPARATUS.
The oscillograph tube.

duced at the receiving station, giving in the telephone a distinct reproduction of the words spoken at the other end. Now this system is obviously practicable within only a rather limited range, the foremost condition being that the two stations be situated in sight of one another. In the case of distances exceeding even a mile or so the stations communicating with each other—or at least one of them—should therefore always be placed on some elevated spot, which is not always feasible.

Endeavors were therefore made by various experimenters to use electric waves—in a way similar to that in wireless telegraphy—in the place of light waves, for transmitting the human voice to a distance, without any material connection between the transmitting and receiving stations. As, however, electric waves generated by spark discharges rapidly decrease in amplitude no practical results were obtained in this line.

Now, some pioneers in the field of wireless telegraphy have quite recently succeeded in increasing the frequency of what is called a "singing" or "speaking" electric arc, by placing the latter in an atmosphere of hydrogen—as suggested by Poulsen—or cooling the electrodes of the arcs—as achieved by the Telefunken Co. of Germany—and thus advancing into the range of electric oscillations or waves. A practical solution of the problem of electric wave telephony has thus become possible. In fact if such undamped electric vibrations are influenced in some manner corresponding to the talk to be transmitted, the latter will be reproduced

at the receiving station, a telephone being actuated by the electric waves sent out from the starting point with the characteristic modulations corresponding to the sound waves.

The above principle thus is identical with the principle used in optical wireless telephony, but for the substitution of the far more rapid light waves as carriers of language.

The sending apparatus used in wireless telephony is based on a vibratory circuit permanently crossed by free electric waves, and which, for giving out electric waves, is coupled in exactly the same way as in wireless telegraphy, with a tuned open vibratory system in the shape of a steel wire aerial.

Now there are two possibilities of acting on electric vibrations through the agency of the human voice according as either their intensity is influenced in a manner corresponding to language—without any variation in frequency—or else the characteristic vibration of the closed or open vibratory system is altered. In both cases electric waves undulating in accurate agreement with the sound waves will be produced, their frequency being either constant or variable.

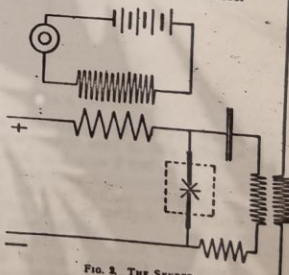


FIG. 2. THE SENDER.

At the receiving station a wave detector—sensitive to fluctuations in intensity—arranged in series with a telephone and battery, will be used in a way quite analogous to wireless telegraphy. In the case of constant wave lengths an alteration in the intensity of the wave will re

*This is one of my
earliest inventions.*

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TALKING BY WIRELESS

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sult in a corresponding alteration in the effect exerted on the receiver, while with variable wave lengths a variable number of waves will, during the same time act on the receiver, the effect on which thus depends on the number of arriving waves of constant intensity.

Mr. E. Ruhmer of Berlin has just succeeded in obtaining a first practical solution of the above problem, an account of which he communicated to the International Conference on Wireless Telegraphy which was recently held at Berlin.

A sending apparatus arranged according to Poulsen was used, comprising a "singing" arc lamp arranged in a hydrogen atmosphere and being fed with direct currents at 220 volts. The vibratory circuit was constituted by a capacity consisting of seven Leyden jars—of about .002 microfarads—an adjustable self-induction coil and the primary coil of a Tesla transformer. In the case of a convenient tuning a high tension flaming arc, several centimeters in length could be maintained quietly burning between the secondary terminals of the Tesla transformer.

On examining this electric arc it was found to show the appearance of a continuous-current arc, its frequency—about 300,000 per second—being far too high to decompose it into individual spark discharges. This observation induced Mr. Ruhmer to alter the generation of waves in the same way as the "speaking" arc lamp. The choking coil so far inserted in the feeding circuit of the arc, and which was intended to prevent any reaction of the rapid oscillations on the direct current circuit, was replaced by an induction coil the secondary winding of which was connected to a transmitter and battery (fig. 1). This experiment proves successful, as on talking into the transmitter the oscillograph tube—an instrument for measuring the shape of the wave—distinctly showed a glowing band of variable luminous intensity with notches corresponding to the sound waves, showing the intensity of the high frequency currents in the secondary coil of the Tesla transformer to be influenced in a manner corresponding to the spoken words. While being unable to decide which of the two processes above referred to has been realized in the present case, Mr.

Ruhmer is inclined to suppose the existence of a composite effect, depending on an alteration both in the wave length and intensity of the electric oscillations.

Whenever a flaming arc was fed with undulating high frequency currents, this would render clearly and distinctly any word spoken in the transmitter, in fact with an intensity exceeding that of the familiar direct-current "speaking" arc.

After these successful preliminary trials, there was not much left to be done before the human voice could be transmitted by the same

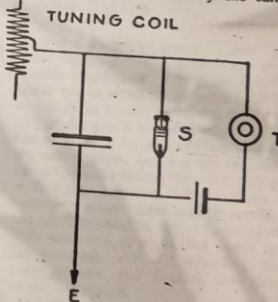


FIG. 2. THE RECEIVER.

process with the aid of electric waves. The arrangement used to this effect is represented in figures 2 and 3.

After first using a transmitter contact as wave detector, Ruhmer eventually replaced this by an electrolytic cell, which proved more efficient.

Experiments so far made, while being confined to the inventor's laboratory, gave surprisingly favorable results, spoken words being transmitted, with the aid of an aerial one and one-half meters in length, to the available distance of thirty meters.

Mr. Ruhmer is actively engaged in continuing these interesting experiments and confidently hopes by this method to bridge distances of several kilometers, provided aerials of sufficient length be employed. The most advantageous feature of this method seems to be the

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fact that a most accurate tuning can be obtained such as that required for two stations to communicate with each other without any risk of interference on the part of a third party.

The utility of the wireless telephone will probably be first seen in its applica-

tion to vessels as a means of lessening the danger of collisions. This is a field already taken by space telegraphy but involves the presence of a skilled operator constantly at the side of the officer in charge—an objection which will not apply to wireless telephony.

Noisiest Whistle in the World

By James Cooke Mills



F a voice from Bedlam like a triple blast of a monster siren, rendering dumb all the little noises, yelps, toots, and whines of smaller mechanical throats, should suddenly pierce a traveler's ears, it is very likely he would quickly cover them and wonder what had broken loose. A hundred chances to one, when the roaring blast had ceased, he would seek the cause of the uproar to register his denunciation of the giant whistle trust, a noise combine, that has throttled all the smaller whistles in a radius of twenty miles.

But if he sought a resident of East St. Louis—the busy St. Louis suburb across the Mississippi—and necessarily a victim of the nerve-racking and discordant blasts proceeding from the manufactories, he would be told that the seemingly terrible, three-mouthed monster is a blessing in disguise to the 100,000 people living within the range of its deep, penetrating blasts.

East St. Louis probably had more independent whistles than any other city of like size in the country, and exercised them more. Each factory possessed its special whistle, actuated in accordance with its particular clock; and scarcely two time-pieces being exactly synchronized, the din produced by the various sirens, each of which had a distinctive tone, was a discordant jamboree.

Whistles blew at all kinds of time—tramp, local, and standard, also in variations. The iron and steel foundry's

whistle sounded at seven o'clock by its clock time, and the aluminum works' whistle sounded at 7:05 by the foundry's clock, but at seven by its own. Whistles on the glass works, elevators, flour mills, gas works and a hundred others in various lines were let loose before and after the correct time, and for ten minutes or more residents throughout the city were in despair. In some factories there was a rivalry to see whose whistle would get the air first; and in this way many minutes were lost at night, but made up in the morning. All this whistling meant extravagance, and discord, and danger to the ear drums.

In order to reclaim the city from this whistling babel a practical way was devised by L. C. Haynes, general manager of a suburban electric railroad. The company communicated with various industrial concerns in the city, proposing to establish one powerful steam whistle in a central location, to serve all the manufactories. The plan was adopted, and it was generally agreed that the new siren should have a loud and penetrating tone capable of being heard at least ten miles, but that its voice was not to be objectionably shrill.

After careful designing, an immense siren, the greatest whistle in the world, was made and installed on the power house of the railroad company. This great modern siren comprises three whistles. The largest is almost six feet in height and nearly as large in diameter as a man's body. On each side of the main whistle there is a smaller one. T

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Tesla, Nikola
The 10 greatest inventors..., by John S. Seymour
n.p., [Dec. 1923]
a.ms., 1p. (comment written by N. Tesla at foot of p. 138
of article in Popular Science Monthly, Dec. 1923, p.35-37, 137-138)

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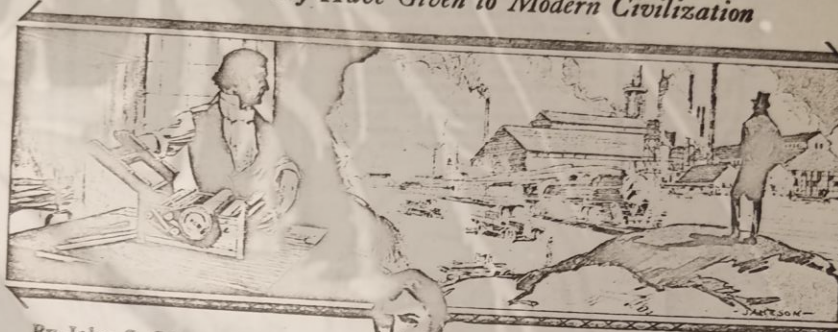
The 10 Greatest Inventors

And What They Have Given to Modern Civilization

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By John S. Seymour,
Formerly United States Commissioner
of Patents

I AM to select the 10 greatest inventors of modern times, and in doing so my guide and chart necessarily must be the history of past achievements as reflected in present-day civilization.

When mankind began on earth, hundreds of thousands of years ago, there was no knowledge of fire or of pottery, of the bow and arrow, of domestic animals, of iron or of writing. There was no articulate speech. In the progress through savagery and barbarism, this knowledge was acquired little by little, and with it came the beginnings of civilization.

From the time of the revolutionary discovery of fire the progress of invention was steady but unspectacular until 400 years ago, when a series of discoveries gave a tremendous impulse to civilization. These discoveries were gunpowder, the mariner's compass, paper, and the printing press, the Copernicus demonstration that the sun, and not the earth, was the center of the solar system, and the discovery of America.

Pathfinders of Modern Progress

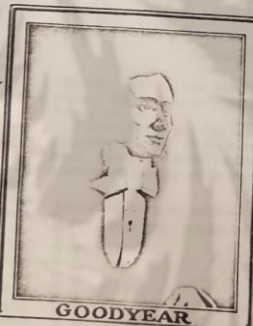
Then began the era of modern progress. From this era I have selected the 10 inventors whom I consider the greatest, basing my judgment on their work—its utility, originality, and its permanent value in meeting the needs of mankind. These 10 greatest, all of whom have lived within the last 150 years, are:

Eli Whitney	Elias Howe
Charles Goodyear	Sir Henry Bessemer
Samuel F. B. Morse	Thomas A. Edison
Alexander Graham Bell	Nikola Tesla
Cyrus Hall McCormick	Wilbur Wright

Here we have the creators of the cotton gin, the vulcanizing rubber process, the telegraph, the telephone, the reaper, the sewing machine, the quantity production of steel, the incandescent light, the alternating current, and aviation; inventions great in themselves and each of them stepping stones to greater benefits to men.



WHITNEY



GOODYEAR

Eli Whitney's cotton gin dates back to 1793, 50 years before the telegraph of Morse, the sewing machine of Howe, the vulcanization of rubber by Goodyear and the reaper of McCormick. Among the 10 immortals of modern invention Whitney was the pioneer, not only because he invented the cotton gin, but

because he led the way in a development from which most great manufacturing enterprises of today draw their life blood—the standardization of parts. Firearms were the principal mechanical contrivances of Whitney's day. They were made almost entirely by hand, and no two corresponding parts were exactly alike. Whitney was the first to realize that by making duplicate parts interchangeable for repairs, an appalling waste in material and labor would be eliminated. In achieving this end, he paved the way for the quantity production of watches, motor cars, and thousands of mechanical articles in use today.

Whitney's invention of the cotton gin was original and basic and useful. The cotton that we use today in myriad forms and fabrics, would not be ours in the huge quantities we need and at prices we can afford to pay had not Whitney's genius prepared and lighted the way.

Father of the Rubber Industry

To Charles Goodyear we owe our multifarious use of rubber—waterproof shoes and clothing, fire hose, combs, insulation for electric wires, rubber tires, and even golf balls. Prior to Goodyear, the treatment of rubber was primitive, faulty, and unsatisfactory. In hot weather the rubber became too soft. In cold weather it was too hard. Daniel Webster, describing his experience with a rubber cloak and hat, made prior to Goodyear's discoveries, said:

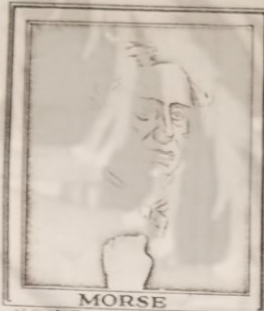
"I put the cloak outdoors one cold day, and it stood alone. This interested me and I tried placing the hat on the top of the coat. The effect was strikingly lifelike and passers-by, seeing the effigy on the outside, thought it was myself



ALFRED VAIL
BART LUDK
Cyrus Hall

Tools. 10
The 10
S.D., 1
S.M., 1
of 10

213807



and hailed me in a neighborly fashion." Chance played a part in Goodyear's success. He accidentally placed a piece of rubber mixed with sulphur on the kitchen stove. Instead of melting in contact with the hot iron, the mixture became hard. Subjecting the hardened specimen to further heat altered it not a bit, nor did it lose its flexibility when left outside the house in the winter air until morning. The problem of vulcanizing rubber was solved and Charles Goodyear earned his place among the great pathfinders of human progress.

A chance conversation played its part in furnishing the world with the electric telegraph, uniting the ends of the earth, pulling down the barrier of time and bridging a thousand gulfs.

How Morse Conceited Telegraph

At the age of 40, Samuel Finley Breese Morse was a successful artist. Returning from Europe in 1832, after a trip abroad to widen his knowledge of art, he heard a fellow passenger describing a recent electrical experiment. An electric current had been passed through a chain and bright flashes of light were visible among the links. To Morse, though untrained in science, occurred instantly the thought, "if electricity can be made visible it can be employed to carry messages."

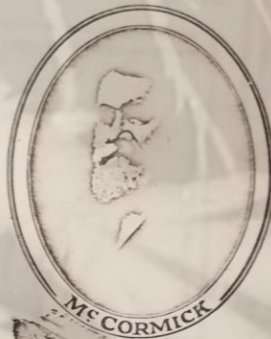
Before the ship reached New York, Morse had evolved the general scheme of the Morse Code, and had even named the invention he intended to make some day, the "telegraph." As he left the ship he said to the captain, "If you hear of the 'telegraph' some day as the wonder of the world, remember that the discovery was made on your ship."

In January, 1838, his first message was clicked off over three miles of wire stretched about the room in which he

worked with his associate, Alfred Vail. On May 1, 1844, when the Baltimore and Washington line had been completed, Morse signalled the nomination of Clay for President to the national capital, where the news was received with amazement.

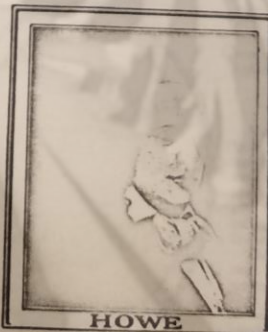
Morse lived to the age of 81, and saw the earth engirdled by wires. No man holds a more secure place among the great.

Alexander Graham Bell is the real father of the telephone, while Reis, Edison, Gray, Dolbear, Berliner, Hughes, Blake, and others are supporting con-

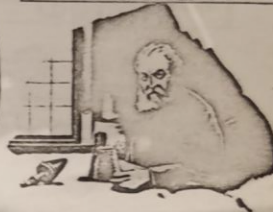


tributors. Others had the interrupted current; Bell had the continuous undulating current.

It is incorrect to say that the telephone transmits speech. It transmits only a small, silent, continuous variable electric current and thereby at the receiving end



HOWE



speech is reproduced by the vibrations of a diaphragm. In his application for his fundamental patent in 1876, Bell said nothing about transmitting speech nor reproducing speech at a distant point; his invention up to then was concerned with the reproduction of pitch and music. Then some one accidentally spoke into the transmitter and to the astonishment of all, the words were reproduced at the receiving station. The telephone was complete before it was known that it could reproduce speech. Once regarded as a toy, it has experienced an amazing growth, more intensive in America than anywhere else. Today there are 14,000,000 telephones in the United States averaging 35,000,000 messages a day.

McCormick's Reaper Was Sneered At

Through the reaper of Cyrus Hall McCormick the world gets its bread. Yet when this machine was first exhibited at the World's Fair in London, the public smiled dubiously and the London Times ridiculed the contrivance as "a cross between a circus chariot, a wheelbarrow, and a flying machine."

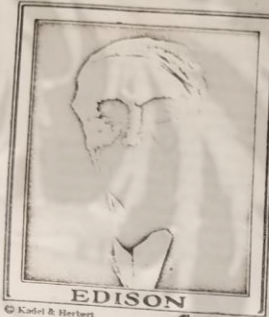
McCormick's father had tried to develop a reaping machine and the son began work on a reaper during his boyhood days. By 1831 the younger McCormick had developed a machine that cut six



THE
RARE LOG
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Tesla.
The J
S.D.,
A.M.S.
of

ELROY



EDISON

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acres of oats in one afternoon—equivalent to the work of six men with the scythe. Forty-six other inventors before McCormick had attempted to develop a mechanical harvester and had failed. Cyrus Hall McCormick leveled the obstacles and made a device that was revolutionary and epochal. The descendants of his first reaper still harvest the grain crops of the world.

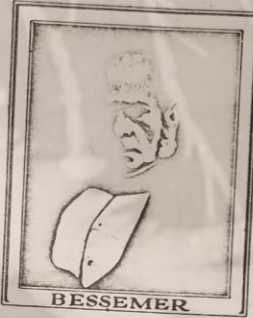
Howe and His Sewing Machine

Circumstances were a powerful factor in the invention of the sewing machine, the greatest of all labor savers for the home. Elias Howe was lame and richly. His wife contributed to the family income by sewing. Unable, because of his health, to relieve her from her irksome labor, Howe sought to lighten it by devising a machine. To imitate the motions with which a woman sewed he produced a needle pointed at both ends with an eye in the middle, which worked up and down. But after repeated failures Howe saw that the machine should have characteristic motions of its own. In applying this thought, Howe made use of the shuttle with which he had become familiar in working with the looms of the mills. At last he evolved a lockstitch from the shuttle and gave the world the first



successful sewing machine in April, 1845. The number of useful articles made cheap and available by the sewing machine runs into the thousands. Few inventors of all time have performed a more useful work than Elias Howe.

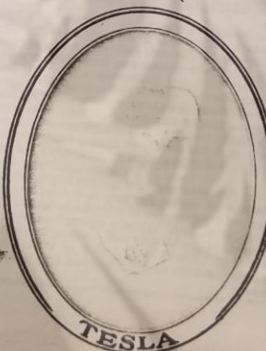
The machinery of today that produces the food we eat, the clothes we wear, the cars we ride in, the offices and factories we work in, the rails on which we travel, is linked with the epoch-making material in the world's history—steel. Steel in small quantity was the possession of mankind for many centuries. But



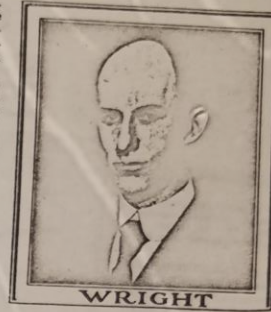
BESSEMER



quantity steel marked the beginning of a new era—the modern age of steel. This age was born of a boy's fondness for casting mixtures from type metal. That boy was Henry Bessemer of England. Through his persistent genius he became the inventor of the Bessemer process of converting pig iron into steel and by that inven-



TESLA



WRIGHT



tion takes his place among the great. This idea of converting iron into steel originated in Bessemer's efforts for devising heavier projectiles for cannon. The remark of an army officer that heavier projectiles would be of little value without stronger steel for the guns, stirred Bessemer on to experiments with molten iron. Soon he discovered that when a mass of molten iron came into contact with air under specific conditions, the carbon content, and therefore the hardness of the metal, could be controlled.

It was only a short step to the completion of the process of converting pig iron into steel by forcing air into the molten metal, a process that brought steel into every-day use, in quantity, and created the modern industrial giant with its railroads, bridges, ships, automobiles, and skyscrapers.

Paralleling the age of steel is the new age of electricity, which, though still in its infancy, already is remaking the world, linking states and nations with networks of quick communication, lighting homes, supplying conveniences and labor-saving instruments and carrying the power of rivers and streams to turn the wheels of industry and to run our trains.

Cheaper Power from Waterfalls

Until recent years the factory had to be built alongside the waterfall. This involved expensive transportation of products to distant markets. Now a turbine and a generator at the waterfall may supply cheap power to a factory a hundred miles away, and to hundreds of intervening small power users.

The possibilities of electricity in the next century baffle the imagination; but we have the word of no less an authority than Charles P. Steinmetz that they will far eclipse the achievements of the last hundred years.

(Turn to page 137)



Power and Light from the Limitless Winds

By F. A. Platte

Instructor, Department of Physics,
Columbia University

IN THE light of present-day developments in methods of capturing and utilizing natural sources of power, most persons probably look upon the windmill, devised by man some time prior to the twelfth century, as hopelessly obsolete, except in isolated sections. Yet, in the opinion of leading engineers, this is far from being the case.

Improved windmills, they say, not only are valuable adjuncts to modern power-generating devices, but they possess individual merits of their own. In fact, they are so useful for many sorts of power work that they may find more extensive use in the future than in any period in history.

May Drive Locomotives

A striking example of the possibilities of the modern windmill is found in East Prussia, Germany. There 11 windmills of the type pictured on this page have been constructed recently to supply electric power during the existing coal shortage. So efficiently have the wind motors operated in supplying current for electric light and to run irrigation machinery, that steps now are being taken to use wind-generated power to drive locomotives of a local railroad that was forced to suspend because of the nationwide coal shortage.

The power generated by revolution of the windmill wings turns a dynamo, and the energy produced is held in storage batteries. This method of transforming the power of the wind into electric current has been employed before in this and other countries, but the wind motors constructed in Germany are unique in many important particulars.

For one thing, the new windmill, unlike all other types, requires no indicator, or tail, to keep it headed to the wind, and its blades always present their maximum surface to the wind. Its wind wheel is self-adjusting. Such an effect is produced by having the blades turn about a revolving wheel that rests on ball bearings and automatically keeps its axis at right angles to the direction of the wind. This feature permits the wind wheel to utilize the

entire force of the wind for power production. In the picture at the top of this page the wind is blowing from the direction of the observer. Under the same conditions in any other type of windmill



This photograph shows one of the giant windmill power stations established in East Prussia to generate electricity for light and power during coal shortage. They may be used to run railway trains

the wind wheel would be on the observer's side of the tower.

The design of the wings is simple yet original. Every known scientific fact regarding windmills and wind motors was taken into consideration in

Our artist's conception of the wind-motor system, showing the inside of the power plant and transmission lines

their construction in order to produce maximum power from minimum air movement. The wings were designed by a noted manufacturer of airplane propellers, and were tested in the aerodynamic laboratories at Göttingen, Germany, before installation.

Moved by Light Breeze

A breeze barely sufficient to stir the leaves of the trees will set the great wings in motion, although the circle they describe is almost 60 feet in diameter. Once started, they will continue to revolve as long as there is the faintest movement in the air. A normal wind will produce about 40 horsepower and a strong wind 70. On days when every other windmill near by is still, those of the new design are supplying power.

An ingenious "brake" prevents the arms from turning too rapidly in a gale. At the tip of each arm is a disk that rises from centrifugal force as the speed of the wings increases and opposes their motion. The faster the wings turn, the further out these disks extend, so that no matter how strong the wind, the speed of the wind wheel is always kept within reasonable bounds.

The towers upon which the arms are mounted are about 50 feet high. They are cylindrical in shape, built of iron and cement.

The construction cost of the wind motors is said to be relatively low, considering the amount of power they produce. American and European engineers are watching the new method of harnessing the wind with eager interest. They see in it a valuable auxiliary to our present methods of producing electric power.

A resident of East Cleveland, Ohio, who lights his home with power generated by a windmill of a different type, described on page 69 of this issue, testifies to its efficiency and economy.

"Wind Power a Substitute for Coal"

JAMES LORING ARNOLD, professor of electrical engineering at New York University, commenting on the German wind motors described on this page, says: "Utilizing the wind as a source of electric power is entirely feasible from an engineering point of view. The supply of electricity, of course, would vary according to the prevalence of wind, but the energy produced could be handled exactly as in the automobile, where the generator speed varies with the rapidity with which the car is moving. That is to say, from which electricity at constant voltage could be procured for motors and lights."

"The principal reason why we have not utilized the wind for the production of electric power in America is that the installation of windmills is expensive when compared with cost of coal and water plants. Also, coal and water assure us of constant power. But should coal become too expensive or should there be a dearth of it such as now exists in Germany, we might have to turn to intermittent wind power."

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by Tesla)

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PROSPECTUS FOR MR. TESLA'S NITRATES COMPANY.

Discoveries
Nikola Tesla, whose ~~inventions in high frequency~~ *discoveries* have formed the basis of so many ~~modern~~ *modern* more recent practical applications of electricity, and which by ~~their world-wide recognition have given this inventor a prominent~~ *position in the field of electricity, has, by a series of discover-* ~~ies extending over many years, and all protected by United States~~ *has evolved a new and efficient process for* ~~in all the great countries of the world, and has been~~ *the fixation of atmospheric nitrogen, that is, its chemical combination with* ~~the oxygen of the atmosphere~~ *the oxygen of the atmosphere* which, by its tremendous value and wide-reaching influence, bids fair to outrank many times his wonderful invention of the alternating current motor.

(Cover)
First, that his high-frequency electric discharges in the atmosphere give in a much more effective degree a peculiar electric chemical stress, which brings about this most difficult of combinations; a stress which all workers in this field have recognised for years as being one which not only must be of tremendous power, but of almost infinite suddenness. The time element which has so materially interfered with the success of other workers in this field, has, by Mr. Tesla's invention, been almost entirely removed as an objection.

Second, Mr. Tesla's peculiar means of obtaining phenomenally high voltages (running into the millions of volts) from apparatus of most moderate dimensions enables him to obtain the

+ ~~He~~ ^{could} ~~recognized~~ ^{recognized} the immense possibilities of such
 a departure, and in an article published a few years
 ago he made the startling prediction that the ~~electric~~ ^{electric} fixation of atmospheric nitrogen would before long develop into
 an industry rivaling that of iron in importance. At that time nothing had been
 done towards commercial exploitation. Now there is his foresight
 shown by the fact that in ~~various~~ ^{various} countries ~~astronomical~~ ^{astronomical}
 plants have been installed since ~~and large investments have been made.~~ ^{and large investments have been made.} In
 Norway, ~~which the completed plant~~ ^{which the completed plant} ~~costs~~ ^{costs} ~~one quarter of a million~~ ^{one quarter of a million}
 pounds and produces ~~100,000~~ ^{100,000} ~~tons of~~ ^{tons of} ~~nitric acid~~ ^{nitric acid}
~~per annum.~~ ^{per annum.} ~~and fifty million dollars have been already invested in the industry.~~ ^{and fifty million dollars have been already invested in the industry.}
~~on the~~ ^{on the} ~~method~~ ^{method} ~~and apparatus~~ ^{and apparatus} ~~satisfying~~ ^{satisfying} ~~no more than 5 per cent~~ ^{no more than 5 per cent}
 of the electric energy of the current, ~~and although~~ ^{and although} ~~but the~~ ^{but the} ~~first cost~~ ^{first cost} ~~is so great~~ ^{is so great} ~~that the~~ ^{that the} ~~business~~ ^{business} ~~is not~~ ^{is not} ~~attractive to capital.~~ ^{attractive to capital.}
 The fixation or burning of atmospheric nitrogen
 is effected economically ~~by~~ ^{by} ~~lightning~~ ^{lightning} ~~discharges~~ ^{discharges} ~~which~~ ^{which} ~~precipitate~~ ^{precipitate} ~~from four to twenty pounds of nitrogen~~ ^{from four to twenty pounds of nitrogen}
 compounds per acre per year, an enormous amount
 when considering their scarcity. This high efficiency
 is due to the great power, suddenness, length and volume of
 the discharge, and instant cooling, rendering therefore
 the ideal requirements are fulfilled in
 the new ~~process~~ ^{process} ~~designed by the~~ ^{designed by the} ~~Toshiba Nitrogen Company.~~ ^{Toshiba Nitrogen Company.}
 The "Toshiba Transformer" ~~is~~ ^{is} ~~designed~~ ^{designed} ~~for~~ ^{for} ~~the~~ ^{the} ~~production~~ ^{production} ~~of~~ ^{of} ~~electric~~ ^{electric} ~~effects~~ ^{effects} ~~of~~ ^{of} ~~virtually unlimited power, surpassing~~ ^{virtually unlimited power, surpassing}
 even those of lightning, ~~as has been demonstrated in actual experiments~~ ^{as has been demonstrated in actual experiments} ~~by the~~ ^{by the} ~~inventors.~~ ^{inventors.}
 The high frequency, or so-called ~~Toshiba~~ ^{Toshiba} ~~currents~~ ^{currents} ~~have~~ ^{have} ~~the~~ ^{the} ~~peculiar property~~ ^{peculiar property} ~~of~~ ^{of} ~~accelerating~~ ^{accelerating} ~~the~~ ^{the} ~~electrical~~ ^{electrical} ~~effects~~ ^{effects}
 of nitrogen, causing the gas to combine ~~and~~ ^{and} ~~with~~ ^{with} ~~a~~ ^a ~~lower~~ ^{lower} ~~expenditure~~ ^{expenditure} ~~of~~ ^{of} ~~energy.~~ ^{energy.}

XXXX

attenuated are so necessary for the highest efficiency.

Third, by virtue of the peculiar nature of Mr. Tesla's transformer, he is enabled to produce a certain tonnage of product with such a small amount of apparatus and a consequently reasonable investment as to multiply a thousand-fold, the capacity efficiency of his plant. This item is of vast importance in connection with this subject. Many experimenters have produced nitric acid from the atmosphere and there are now some very large plants engaged in this industry, one particularly in Norway, that involves upwards of \$50,000,000 and which will absorb some 200,000 horse-power when it is fully expanded, but without exception all these efforts have resulted in a first cost of apparatus so great that the interest and maintenance alone thereof puts a fixed charge upon each ton of the product that has heretofore rendered the business indifferently attractive to capital. Ignoring, therefore, for the moment, the increased efficiency claimed by Mr. Tesla, or his novel method of burning the atmosphere, and granting

only that he shall burn it as it has been done before by ^{assuming} ~~attending~~ that his devices are applied to the old process, the commercial advantages secured will still be such as to make the success of the project absolutely certain. ^{if there can be had of a reasonable price, for} ~~some time to get power at a sufficiently reasonable price to make~~ ^{the plan instead of costing \$50-100 dollars, per ton of enamel product, will cost only for an} ~~and its cost (and all nitrate prepared thus from the atmosphere~~ ^{are pure) sold from \$100 to \$200. per ton, and even the grade} ~~of the nitric acid and its salts thus prepared are of great purity and sell at~~ ^{100-200 dollars for ton on the Chili salt-peter with 5% of} ~~impurities, sell for \$65. and better.~~ ^{such an installation} ~~require a small charge of investment of \$5. or \$10. per ton of put-~~ ^{put becomes.} ~~The operation of these plants, like those of hydro-~~ ^{There is no essential} ~~and care.~~

1111 8. This insuperable singleness, removes one
great obstacle which has so materially interfered
with the success of the old method, and affords
a better means for generating enormous pressure
pressures with apparatus of comparatively minute
dimensions, suitable for the production of direct
charges of air of the great length and volume
so necessary to the highest efficiency.

9. By this means it is possible to operate vessels
of any capacity, however great, to burn the air
at any desired rate and this process
is thousand fold the effectiveness of the piston.
The Torus operates very like a turbine
running at a stupendous speed, while the
~~efficiency~~ ~~for~~ ~~applies~~ is comparable to
an old-fashioned engine turning slowly. For
the same performance the latter is overpowered
and cumbersome and expensive. ~~This is~~
~~a very serious~~ ~~the~~ ~~fact~~ ~~and~~ ~~the~~ ~~charge~~

10. This has of vital importance to
the enterprise reducing, as it does, to a minimum
the first cost and ^{the burden of} fixed charges. To
illustrate, ~~whereas~~ ~~that~~ disregarding xx (other side)

part ^{of the plant} ~~of the plant~~ subject to rapid ^{deterioration} ~~wear and tear~~; in fact, most of it is ^{good for one hundred years} ~~good for one hundred years~~ and consists principally of brick ^{and metal and is good for centuries} ~~buildings, transformers, brick or tile combustion chambers and equipping powers or their equivalent~~. The process is a continuous one and once started requires no manual labor, ^{electricity} ~~electricity~~ continuing to burn the atmosphere ^{into} ~~into~~ nitric fumes, which in turn combine with water to make nitric acid, and this goes on until the ~~current~~ ^{current} is switched off, and immediately recommences when the ~~current~~ ^{current} is ~~again~~ ^{switched} on. There is no loss upon the discontinuing of the process for an hour, a day, a month or a year, ^{other than} ~~except that~~ due to plant lying idle and carrying ^{its small} ~~its small~~ of interest. It is obvious, therefore, that it ^{only remains to obtain power at a sufficiently} ~~only remains to obtain power at a sufficiently~~ reasonable ^{by the use of this revolutionary process a cost} ~~to make an almost unlimited industry of this~~ ^{can be built up} ~~with a very reasonable investment of capital yielding annually a return many times the first cost.~~

The Tesla Nitrates Company owns the exclusive rights under the ~~the~~ United States patents granted to ^{and} ~~and~~ Tesla, applicable to the manufacture of nitrates from the atmosphere, ^{which are the following:} ~~which are the following:~~ ^{of his own} ~~of his own~~ future ^{improvements, he may make} ~~improvements, he may make~~ relative to this subject, and ^{he will get the benefit of his assistance and advice.} ~~he will get the benefit of his assistance and advice.~~ It is ^{proposed} ~~proposed~~ to immediately make a demonstration of the ^{salient advantages of the novel process with a model plant} ~~salient advantages of the novel process with a model plant~~ on the ^{commercial} ~~commercial~~ magnitude in the immediate vicinity of New York City, where experts and investors may see ^{for themselves} ~~for themselves~~ the practical application of ^{his} ~~these~~ inventions, ^{and judge for themselves of their value.} ~~in a full-sized unit~~ apparatus. In making this test, Mr. Tesla will have at his disposal, a plant that has already cost over \$800,000, a large part of which will be immediately available. It is estimated that ~~this test will involve an expenditure of \$25,000~~ ^{will be ample to meet} ~~for the test~~

ishing of the additional apparatus, partly for attendance and
all expenses in the connection. In addition the plant will serve
operation and partly for the very full and exhaustive demonstra-
the important purpose of exhibiting during the latest improvements
tion which it is proposed to be made
prior to their application on the large scale contemplated.

XXXX Mr. Tesler is now devoting himself to
the perfection of plans for ~~small~~ large ^{installation} plant
being installed in this work by a ~~small~~ ^{large} ~~number~~
purchase of international capital
projected engineer. He has ~~been~~ ^{been} for a long time
~~been~~ ^{been} a long experience in the fixation of Nitrogen
by the old method and is thoroughly familiar
with all ~~the~~ facts pertaining to the manufacture
and sale of the products. In the near
future X K

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Tesla, Nikola
Tesla's New System of Fluid Propulsion
n.p., n.d.
t.ms., 20 p.

21380E

TESLA'S NEW SYSTEM OF FLUID PROPULSION

In subduing the forces of Nature to his service man must invariably avail himself of some process in which a fluid acts as carrier of energy, this being an essential step in any industrial undertaking dependent on mechanical power. Evidently then, a discovery or radical departure in that domain must be of extreme importance and far-reaching influence on the existing conditions and phases of modern life.

Fluid propulsion is now effected by means of pistons, vanes or blades, which entail complexity of construction and impose many limi-

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Fluid propulsion is now effected by means of pistons, vanes or blades, which entail complexity of construction and impose many limi-

tations on the propelling as well as propelled mechanism and its performance. Tesla has dispensed with these devices and produced machines of extraordinary simplicity which, moreover, are in many other respects superior to the old types universally employed. A few words will be sufficient to convey a clear idea of his invention.

Every fluid, as water or air, possesses two salient properties: adhesion and viscosity. Owing to the first it is attracted and clings to a metallic surface; by virtue of the second it resists the separation of its own particles. As an inevitable consequence a cer-

tain amount of fluid is dragged along by a body propelled through it; conversely, if a body be placed in a fluid in motion it is impelled in the direction of movement. The practical forms of Tesla's apparatus consist of flat, circular disks, with central openings, mounted on a shaft and enclosed in a casing provided with ports at the peripheral and central portions. When deriving energy from any kind of fluid it is admitted at the periphery and escapes at the centre; when, on the contrary, the fluid is to be energised, it enters in the centre and is expelled at the periphery. In either case it traverses the in-

terstices between the disks in a spiral path, power being derived from, or imparted to it, by purely molecular action. In this novel manner the heat energy of steam or explosive mixtures can be transformed with high economy into mechanical effort; motion transmitted from one shaft to another without solid connection; vessels may be propelled with great speed; water raised or air compressed; an almost perfect vacuum can be attained, substances frozen and gases liquefied.

While this improvement has the broadness and applicability of a fundamental mechanical concept, the widest field for its

commercial exploitation is, obviously, the thermodynamic conversion of energy.

The commercial value of a prime-mover is determined by its efficiency, specific performance relative to weight and space occupied, cheapness of manufacture, safety and reliability of operation, adaptability to construction in large units, capability of running at high peripheral velocity, reversibility, and a number of other features of lesser importance. In the majority of these a machine, operating on the new principle, excels. But there is one quality which is most desirable in a thermodynamic transformer from the

economic point of view, and that is great resistance to deterioration and impairment of efficiency by heat.

The employment of high temperature is of such vital bearing on the efficiency of prime-movers that it is of paramount importance to extend the thermal range as far as practicable. In the present state of the art radical progress towards more economical transformation of the energy of fuel can only be achieved in that direction. Such being the case, the capability of the machine to withstand deteriorating effects of great heat is the controlling factor in determining its commercial value. In that most desired quality the

Tesla turbine surpasses all the older types of heat motors. The Diesel and other internal combustion engines are totally limited in this respect by their complete dependence on closely fitting sliding joints and unfailing supply of clean lubricant; while in the present forms of turbines buckets, blades and inherent mechanical deficiencies impose similar restrictions. These parts are too delicate and perishable to serve as elements of a gas turbine and this has been the main obstacle in the way of its successful realisation. The rotor of the Tesla turbine presents a relatively enormous

active area and the wear is quite insignificant as the fluid, instead of striking against the propelling organs in the usual destructive manner, flows parallel with the same, imparting its momentum by adhesion and viscosity instead of impact. Moreover, it has been shown that the efficiency of this form of rotor is not impaired to any appreciable degree by a roughening of the disks and that it operates satisfactorily even if the working medium is corrosive to an extent.

The universal adoption of steam as motive power under certain standard conditions, settled upon in the course of time, gradually forced upon the minds of engineers the Rankine

Cycle Efficiency as criterion of performance and long continued endeavors to improve the same have finally resulted in complex multistage constructions entirely unsuitable for high temperatures. The Tesla turbine, by virtue of its exceptional heat-resisting and other unique properties, makes possible the attainment of great fuel economy with but a single stage, incidentally offering the additional advantages of an extremely simple, small, compact, and reliable mechanism. But perhaps the chief commercial value of this new prime-mover will be found in the fact that it can be operated with the cheapest grade of crude oil, colloidal fuel, or powdered coal, containing con-

siderable quantities of grit, sulphur and other impurities, thus enabling vast sums of money to be saved annually in the production of power from fuel.

The Tesla turbine also lends itself to use in conjunction with other types, especially with the Parsons with which it forms an ideal combination. Although its practical introduction has been delayed by the force of circumstances, a number of years have been spent in exhaustive investigations and experiments on the basis of which the performance in any given case can be closely calculated. The first public tests were made before the

outbreak of the war at the Waterside Station of the New York Edison Company where several machines, ranging from 100 to 6000 h.p., were installed and operated with satisfactory results. That the invention was appreciated by the technical profession may be seen from the excerpts of statements by experts and periodicals printed on the annexed page.

The salient advantages of the Tesla turbine may be summed up as follows:

EFFICIENCY: The most economical of the present prime-movers is the Diesel engine. But, quite apart of many practical and com-

mercial drawbacks, inseparable from this type,
it is entirely dependent on comparatively ex-
pensive oil, so that the Tesla Gas Turbine,
working with much cheaper fuel, would have
the better in competition even if its effi-
ciency as a thermodynamic transformer were
appreciably lower, all the more so in view
of its greater mechanical perfection.

Referring to turbines, all of
which are surpassed by the Parsons in econ-
omy as well as extent of use, definite lim-
its have already been reached and the only
possibilities of saving fuel exist in the
employment of steam at very high superheat

and utilisation of gas or oil as motive fuel. But none of the primemovers mentioned is adapted for such operation and although every effort has been made in this direction, no signal success has been achieved. The superheat is at most 250° F, this being considered the maximum permissible. All attempts to considerably extend the thermal range have failed chiefly because of the inability of bucket structures to withstand the action of intense heat. The Tesla Turbine can operate quite satisfactorily with the motive agent at very high temperature and, owing to this quality,

lends itself exceedingly well to these purposes.

SPECIFIC PERFORMANCE: In this particular it is superior to all other forms. Each disk is virtually the equivalent of a whole bucket wheel, and as many of them take up but a small width the output of the machine, considering its weight and size, is surprisingly great. This, while not being a measure of efficiency, is nevertheless a feature of considerable importance in many instances.

SIMPLICITY OF MANUFACTURE: The new turbine can be produced without a single machined part except the shaft, all the disks being punched

and the casings pressed. By this method, with proper machinery installed on a large scale, the cost of production may be reduced to a figure never deemed possible in the construction of an engine. What is more, this can be done without material sacrifice of efficiency as small clearances are not essentially required.

SAFETY AND RELIABILITY OF OPERATION: There is an ever present danger in the running of high speed machines. A bucket turbine may at any moment run away and wreck the plant. Such accidents have happened again and again and this

peril has often proved a deterrent to investment.

A remarkable quality of this turbine is its complete safety. As regards the wear and tear of the propelling organs it is significant and, in any event, of no consequence on the performance.

ADAPTABILITY TO CONSTRUCTION IN LARGE UNITS: In all the present machines there is a distinct limit to capacity, for although large units can be manufactured, they are very costly and difficult to manage. The new turbine is so simple and the output so large that the limits in this direction can be greatly extended.

RESISTANCE TO DETERIORATION BY HEAT AND OTHER

AGENTS: In this feature again it has an overwhelming advantage over the old types in which the maintenance of smooth surfaces and sharp edges is indispensable to efficient working.

In the Tesla Turbine, for the reasons already stated, the destructive actions of heat and corrosive agents are much less pronounced and of relatively negligible effect. This fact has a most important bearing on the saving of fuel.

CAPABILITY OF RUNNING AT HIGH PERIPHERAL SPEED:

In this respect also it is superior to others. The rotating structure carries no load and is

excellently adapted to withstand tensile stresses. Judging from the most recent turbine practice this quality should be of special value.

REVERSIBILITY: The present turbines are greatly handicapped by their incapability of reversal which is a very serious defect in certain applications, as the propulsion of vessels, necessitating the employment of auxiliary turbines which detracts from the propulsive power and adds materially to the cost of production and maintenance of the equipment. The Tesla Turbine has the unique

property of being reversible, not only this but it operates with the same efficiency in either direction. For marine purposes it therefore constitutes an ideal motor whether used alone or in conjunction with older types.

Besides the above it possesses other desirable features, constructive and operative, which will add to its value and adaptability to many industrial and commercial uses as, railroading, marine navigation, aerial propulsion, generation of electricity, refrigeration, operation of trucks and automobiles, hydraulic gearing, agriculture, irrigation, mining and similar purposes.

EXPRESSIONS OF OPINION ON THE TESLA TURBINE

- C. B. Richards, Professor Emeritus of Mechanics, Yale University: "I am amazed at the development of power given by the turbine and stunned by the exhibit."
- F. Sargent, Chief Engineer and Turbine Expert: "I am impressed with the newness and novelty of the underlying principle of this invention. It is such as will claim the attention and admiration of anyone of a scientific turn of mind in a mechanical direction."
- Reynold Janney, Chief Engineer, Universal Transmission Co: "It is a great invention."
- Brigadier Allen of the War Department: "Something new in the world. Officers are greatly impressed with it."
- Hiller Reese Hutchinson, Chief Engineer: "It is the greatest invention of the age."
- Arnold Irinyi, Chief Engineer, Oelfourungs-Gesellschaft, Germany: "The ideal of the turbine engine."
- E. R. F. Collins (Power Plant Economist): "It is a wonderful turbine."
- The Motor World: "The new principle unquestionably is a great contribution to science and engineering, great in its simplicity and breadth of application."
- Scientific American: "Considered from the mechanical standpoint, the turbine is astonishingly simple and economical in construction, should prove to possess such a durability and freedom from wear and breakdown as to place it, in these respects, far in advance of any type of steam or gas motor of the present day."
- Engineering Magazine: "An entirely new form of prime mover with interesting possibilities."
- Technical World Magazine: "The Tesla Turbine is the apotheosis of simplicity. It is so violently opposed to all precedent that it seems unbelievable."

From Numerous Articles and Comments:

"The turbine is different in principle to any heretofore in use and one which will take less room and less coal than the best engine now running".....
"Turbine of revolutionary design".... "Improvement in dynamics which promises revolutionary results"..
"Results seem revolutionary to the point of staggering the imagination".... "This motor will revolutionize the turbine industry".... "Wonderful motor. Extraordinary mechanical principle".... etc. etc.

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Tesla, Nikola
Tremendous new power soon to be unleashed, by Carol Bird
n.p., [Sept. 1933]
a.ms., 1p. (comment written by N. Tesla under his picture
in this article published in the Phila. Public Ledger,
Magazine Section, p. 6, 10 Sept. 1933)

21380E

Tremendous NEW POWER soon to be unleashed



By Carol Bird

Nikola Tesla, Starting His 78th Year, Works on Revolutionary Power Project and Also Is Completing Process for Photographing Thought

PROFESSOR NIKOLA TESLA, 77, who has been working on his revolutionary power project for many years, is now completing the process for photographing thought.

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With a source of power obtainable anywhere, will solve many problems. The source of power is now being developed. It is now being developed.

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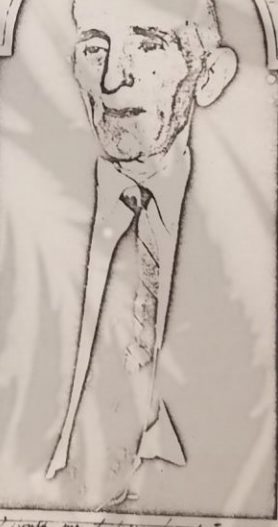
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Nikola Tesla, dean of American inventors, with numerous triumphs in electrical engineering behind him, as he looked on his 77th birthday, which he recently celebrated.

"I expect to photograph thought," says Mr. Tesla. "I expect to photograph thought."

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soon to be unleashed

By Carol Bird

PROVING his theory that a man's efficiency and accomplishments should increase with age, Nikola Tesla, inventor, physicist and one of the world's leading electrical technicians, enters his 71st year busily engaged on three or four great scientific projects.

Several of these inventions or discoveries will be looked upon as "miracles" by many people. For Mr. Tesla has long been a scientist years ahead of his time, one whose advanced theories have alternately stamped him a "madman" and a wizard.

Just as people ridiculed Copernicus' theory of the planetary system, the enlightened hated Tesla's pseudoscience. The age, regarding cosmic rays, the painkiller ether, the ether—and Mr. Tesla is both—are always condemned by the masses.

How does he tap both these deep wells? What is the secret of fine health, keen mind, unusual vitality and mental force at 77, the time of life when most men are sitting in the sun with shawls over their knees or, alas! lying beneath the sand?

Mr. Tesla is the father of the alternating system of power transmission and radio, the induction motor and Tesla coil.

Asked about his startling new scientific discovery, one of which concerns a "photographing of thought," which he said he maintains, being about a tremendous social revolution, he said:

"My first and most important discovery concerns the harnessing of a new source of power, hitherto unavailable, to be developed through fundamentally new machines of my invention.

am not yet prepared to dwell on details of the project, for they must be disclosed before my findings can be fully announced. I have worked on development of the underlying principle for many years. From the practical point of view of the engineer engaged in power development, the first investment will be relatively very great, since a machine is installed it may be depended on to function indefinitely. The cost of operation will be much

power generator will be of the simplest kind—just a big mass of steel and aluminum, comprising a stationary and rotating part, peculiarly suited. I am planning to develop it and transmit it to a distance alternating system now unestablished. The direct-current could also be employed if the insuperable difficulties of the transmission lines can be

Nikola Tesla, Starting His 78th
Year, Works on
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Also Is Completing Process
for Photographing Thought

Such a source of power obtainable everywhere will solve many problems, which the human race is encountering. My alternating system has been the means of providing 30,000,000 horsepower. I have been able to project my power on all over the world electrically. There is no limit to it. But I have found that I need enough waterpower to satisfy the needs of the world. I have been successful, and everywhere I inventors are flocking to me to obtain the additional steps.

[illegible]

BY adding that the new form of KRY which he has been developing for 7 years would be available at any time in the world in unlimited quantities and that the machinery for handling it would last more than 500 years, this KRY would say little more than the subject would say when the power source available to him was not yet conceived. It could not predict with any degree of precision. In a few minutes, then, using the ordinary methods which are available to project the image on a screen.

"If this can be done successfully, the object imagined by a person would be clearly reflected on the screen as they sit in front, and in this way every thought of the individual could be read. Our minds would then, indeed, be like open books."

BRIDGES has diplomatic training and the harvesting of the new energy. Teitel thought and photography, and radio thinking to produce a type of strictest privacy in which he would have the communication of the new communication regarding the number of persons, and he is developing some important work in molecular physics, metallurgy and greatly important science of the future. After a discussion of his new ideas, he said:

ject to photograph "thoughts," and Mr. Tesla calmly, in the face of you, that a person can be photographed.

10

I should use the paper for designs!

Nikola Tesla, dean of American inventors, with numerous triumphs in electrical engineering.

...engineering behind him, as he looked on his 77th birthday, which he recently celebrated

condition of life. My mind is
ago is merely a "certificate" of
have spent our youth. The secret
own strength and vitality today
youth I led what you call a
call a virtuous life.

"We were disappointed. When I was
one man I understood well the
ance that of old French proverb
high I doubt that I had even heard
of the word. I was a young man
understanding while still young
I controlled my passions and appet
I am I want to make some of my

with to continue it until I was
no vacation—no surcease from
where. If people would select a
evertheless with their temperaments,
the subtlest of capricious would
be immeasurably increased."

"Many are saddened and depressed
by the brevity of life. What is the
secret to the secret to accomplish anything? They say, 'Time is short. We
may never live to see the fruition
of the task.' Well, people could prolong
their lives considerably if they would
do more things. Human beings are
made to do things."

with this in view, quite early in set about disciplining myself, and putting out a program of living for

"I expect to photograph thoughts," says Mr. Tesla. "If this can be done successfully, then the objects imagined by a person would be clearly reflected on the screen as they are formed. Our minds would then, indeed, be like open books."

foods and drink I've wrong kind liquids. Most of the harm is done overeating and overexercising, when bring about toxic conditions in the body and make it impossible for the system to throw off the accumulated poisons. My regime for the good life and diet? Well, for one thing, I drink plenty of milk and water.

"Why overburden the body, it serve us? I eat but two meals a day and I avoid all acid-producing foods. Everybody eats too many peas and beans and other foods containing acid and water poisons. I partake liberally of fresh vegetables, fish, meat sparingly, and rarely. Much is said as fine brain food, but has a very acid reaction, as it contains great quantities of phosphorus. Acidity is far the worst enemy to fight off in life.

"Potatoes are splendid, and should be eaten at least once a day. They contain valuable mineral salts and are neutralizing."

"I believe in plenty of exercise. I walk eight or ten miles every day, and never take a cab or other conveyance when I have the time to use legpower. I also exercise in my bath daily, for I think this is of great importance. I take a warm bath, followed by a prolonged cold shower."

"Sleep! I scarcely ever sleep. I come of a long-lived family, but it is not for its poor sleepers. I expect to make the records of my ancestors and live to be at least 100.

MY SLEEPLESSNESS does not worry me. Sometimes I doze for an hour or so. Occasionally, however, I am awake for a few days, once in a few months. I may sleep for one or five hours. Then I awaken usually charged with energy, like a battery. Nothing can stop me after such a night. I feel great strength there. There is no doubt about it but that sleep is a restorer, a vitalizer, that it drains energy. But on the other hand, I do not think it is essential to me. I am well-being, particularly if I am not habitually a poor sleeper.

Today, at 77, as a result of well-groomed life, sleeplessness notwithstanding, I have an excellent certificate of health. I never felt better in my life. I am energetic, strong, in full possession of all my mental faculties. In my prime I did not possess the energy I have today. And what is more, in solving my problems I use but a small part of the energy I possess, for I have learned how to conserve it. Because of experience and knowledge gained through the years, my tasks are much easier. Contrary to general belief, it is much easier for older people if they are in good health, because they are learned through years of practice to arrive at a given place by the "shortest path."

284 206

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Tesla, Nikola
Die Uebertragung Elektrischer Energie
Ohne Draht.
n.p., n.d.
t.ms., 13 p.
(Mitgeteilt an Electrical World and Engineer,
5 Maers, 1904.)

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Spec 2

DIE UEBERTRAGUNG ELEKTRISCHER ENERGIE OHNE DRAHT.

(Mitgeteilt an Electrical World and Engineer, 5 Maerz, 1904.)

Tesla, Nikola
Die Uebertragung
n.p., n.d.
t.m., 1904

Von Nikola Tesla.

213802

Es ist unmöglich Ihrem hoeftlichen Ansuchen, gemacht bei
einer Gelegenheit ^{so bedeutungsvoll} ~~von so grosser~~ Bedeutung in dem Leben Ihres Jour-
nals, zu widerstehn. Ihr Brief hat die Erinnerung an unsere begin-
nende Freundschaft, ~~an~~ die ersten unvollkommenen ^{Befahrungen} ~~Versuche~~ und unver-
dienten Erfolge, ^{Dienste} Gefaelligkeiten und Missverstaendnisse neu belebt.
Auch ~~schmerzliche~~ ^{den} ~~Er hat die Grosse fruherer Erwartungen, das schnelle Entflichen der~~
Zeit und, ^{bedauerlich} ~~echt~~ die Kleinheit der Verwirklichungen ~~schmerzliche~~
ins Gedachtnis gerufen. Die folgenden Zeilen, welche, ~~waere es~~
nicht wegen Ihrer Anregung, vielleicht eine lange Zeit der Oeffent-
lichkeit noch nicht uebergeben worden waeren, sind ein Anerbieten
in der freundlichen Stimmung von Alters her, und meine besten Wuen-
sche auf Ihren zukuenftigen Erfolg begleiten sie.

Gegen Ende des Jahres 1898 fuehrte ich eine systemati-
sche Forschung, der ich seit Jahren obgelegen hatte in der Absicht
eine Methode elektrischer Energieuebertragung durch das natuerliche
Medium zu vervollkommen, zu der Erkenntnis drei wichtiger Erfor-
dernisse: erstens, die Entwicklung eines Senders von grosser Kraft;
zweitens, die Vervollkommenung von Mitteln zur Individualisierung
und Absonderung der uebertragenen Energie; und, drittens, die Fest-
stellung der Gesetze der Fortpflanzung von Stroemen durch die Erde

und die Atmosphaere. Verschiedene Gruende, von denen nicht der geringste die mir von meinem Freunde Leonard E. Curtis und der Colorado Springs Electric Company angebotene Hilfe war, bewogen mich, fuer meine experimentellen Untersuchungen das grosse plateau, zwei tausend Meter ueber der Meeresflaeche, in der Naehc dieses reizenden Kurortes zu wahlen, welchen ich spaet im Mai 1899 erreichte. Kaum war ich einige Tage dort gewesen, als ich mich schon zu der gluecklichen Wahl gratulieren konnte, und ich begann die Aufgabe, fuer welche ich mich lange geschult hatte, mit dankbarem Sinne und voll begeisternder Hoffnung. Die vollkommene Reinheit der Luft, die unvergleichliche Schoenheit des Himmels, der erhabene Anblick einer hohen Gebirgskette - alles rund umher trug dazu bei, die Bedingungen fuer wissenschaftliche Beobachtungen ideal zu machen. Dazu kam noch der belebende Einfluss eines herrlichen Klimas und eine eigenartige Verschaerfung der Sinne. Die Organe unterziehen sich in jenen Regionen merklichen physikalischen Veraenderungen. Die Augen nehmen eine ausserordentliche Klarheit an, was die Sehkraft verbessert; die Ohren troeknen aus und werden empfindlicher gegen Schall. Man kann dort Gegenstaende auf sehr grosse Entfernungen unterscheiden, dass ich vorziehe, diese von jemand anders nennen zu lassen, und ich habe - dies kann ich zu beweugen wagen - sieben und acht hundert Kilometer weit entfernte Donnerschlaege gehoert. Ich haette sie auf noch groessere Entfernungen hoeren koennen, wenn es nicht langweilig gewesen waere, die Ankunft der Laute,

die nach bestimmten Zwischenraeumen erfolgte, genau wie sie - fast eine Stunde im Voraus - von einem elektrischen Anzeigeapparat angekundet wurde, zu erwarten.

In der Mitte des Monats Juni, waehrend Vorbereitungen auf andere Arbeit vor sich gingen, stellte ich einen meiner Empfangstransformatoren auf in der Absicht, auf eine neue Weise, experimentell, das elektrische potentiell der Erdkugel zu bestimmen und dessen periodische und gelegentliche Schwankungen zu beobachten. Dies war ein Teil eines sorgfaeltig im Voraus entworfenen Plans. Eine hoechst empfindliche, sich selbst wiederherstellende Vorrichtung, welche ein registrierendes Instrument kontrollierte, war in den sekundaren Stromkreis eingeschaltet, waehrend die Primaere mit der Erde und mit einem erhobenen Pol von regulierbarer Kapazitaet verbunden war. Die Variationen des Potentiells verursachten elektrische Wogungen in der Primaere; diese erzeugten sekundaeere Stroeme, die wiederum auf die empfindliche Vorrichtung und den Registrator im Verhaeltnis zu ihrer Intensitaet einwirkten. Es stellte sich heraus, dass die Erde buchstaeblich mit elektrischen Schwingungen belebt war, und bald war ich fast gaenzlich in dieser interessanten Forschung vertieft. Bessere Gelegenheiten zu solchen Beobachtungen wie ich zu machen beabsichtigte koennten nirgends gefunden werden. Colorado ist ein Land, das wegen der Entfaltung natuerlicher elektrischer Kraft beruehmt ist. In der troeckenen und verduennten Atmosphaere scheint die Sonne mit grimmiger Intensitaet

auf die Gegenstaende herab. Ich entwickelte Dampf bis auf einen gefaehrlichen Druck in mit konzentrierter Salzloesung gefuellten Faessern, und die Stanielueberzuege einiger meiner erhoehten Pole schrumpften in der feurigen Glut zusammen. Ein experimenteller Hochspannungstransformator, der unvorsichtigerweise den Strahlen der untergehenden Sonne ausgesetzt worden war, wurde durch das Herausschmelzen der Isolationsmischung verdorben. Die Trockenheit und Duernheit der Luft traegt dazu bei, dass das Wasser wie in einem Kessel verdampft, und statische Elektricitaet entwickelt sich in grosser Menge. Blitzentladungen sind demgemaeess sehr Haeufig und mitunter von unbegreiflicher Heftigkeit. Bei einer Gelegenheit fanden in zwei Stunden annaeherd zwouelf tausend Entladungen statt, und alle in einem Radius von gewiss weniger als fuenfzig Kilometer vom Laboratorium. Viele derselben glichen riesenhaften Baesumen aus Feuer mit den Staemmen nach oben oder unten. Kugelblitze habe ich nicht gesehen, aber als Belohnung fuer meine Enttaeuschung gelang es mir spaeter, die Art ihrer Bildung zu bestimmen und sie kuenstlich zu erzeugen.

Am Ende desselben Monats bemerkte ich mehrere Male, dass meine Instrumente durch Entladungen, die in grosser Entfernung stattfanden, staerker beeinflusst wurden, als durch solche in der Naehel. Das war fuer mich ein grosses Raetsel. Was war die Ursache? Eine Reihe von Beobachtungen bewies, dass es nicht von dem Unterschiede in der Intensitaet zwischen den einzelnen Entladun-

gen herruehren konnte, und ich stellte leicht fest, ~~und ich stellte~~
~~leicht fest~~, dass das Phaenomen nicht das Resultat eines variieren-
den Verhaeltnisses zwischen den Perioden meiner Empfaengerstromkrei-
se und denen der irdischen Stoerungen war. Eines Abends, als ich
mit einem Assistenten heimging und ueber diese Erfahrungen nach-
sann, ueberwaeltigte mich ploetzlich ein Gedanke. Vor Jahren, als
ich ein Kapitel meines Vortrages vor dem Franklin Institute und
der National Electric Light Association schrieb, war er mir auch
eingefallen, aber ich hatte ihn als absurd und unmoeglich verworfen.
Ich verbannte ihn wieder. Mein Instinkt war jedoch wachgerufen,
und ich fuehlte irgendwie, dass ich mich einer grossen Offenbarung
naeherte.

Es war am dritten Juli - das Datum werde ich nie vergessen -
als ich den ersten entscheidenden, experimentellen Beweis einer
Wahrheit von ueberwaeltigender Wichtigkeit fuer den Fortschritt der
Menschheit erhielt. Eine dunkle, stark geladene Wolkenmasse sam-
melte sich im Westen. Gegen Abend brach ein heftiges Gewitter los,
welches, nachdem es einen betraechtlichen Teil seiner Gewalt in den
Bergen von sich gegeben hatte, mit grosser Geschwindigkeit ueber
die Ebene dahingefagt wurde. Dicke und lang anhaltende Bogen bil-
deten sich in fast regelmaessigen Zwischenraeumen. Meine Beobach-
tungen waren nun sehr erleichtert, und die schon gewonnenen Erfah-
rungen machten sie genauer. Ich war imstande, meine Instrumente
schnell zu manipulieren und ich war vorbereitet. Da der Registrier-

apparat richtig ajustiert war, wurden seine Anschlaege mit der zunehmenden Entfernung des Gewitters schwaecher und schwaecher, bis sie gaenzlich aufhoerten. Ich beobachtete in begieriger Erwartung. Und wirklich, nach einer kleinen Weile fingen die Anschlaege wieder an, wurden staerker und staerker und, nachdem sie ein Maximum ueberschritten hatten, wurden sie allmaehlich schwaecher und hoerten wieder auf. Viele Male wiederholten sich dieselben Wirkungen in regelmaessig wiederkehrenden Zwischenraeumen bis der Sturm, der, wie einfache Berechnungen erwiesen, sich mit fast gleichmaessiger Geschwindigkeit bewegte, sich auf eine Entfernung von etwa dreihundert Kilometer zurueckgezogen hatte. Und auch dann liessen diese seltsamen Wirkungen noch nicht nach, sondern fuhren fort, sich mit unverminderter Staerke zu offenbaren. Spaeter wurden aehnliche Beobachtungen auch von meinem Assistenten, Herrn Fritz Loewenstein, gemacht, und kurz nachher boten sich mehrere vortreffliche Gelegenheiten dar, die das wirkliche Wesen des wunderbaren Phaenomens noch kraeftiger und unverkennbar an den Tag brachten. Es blieb kein Zweifel; Ich beobachtete stehende Wellen.

Indem die Quelle der Stoebrungen sich fortbewegte, kam der Empfaengerstromkreis nacheinander auf ihre Knoten- und Bauchpunkte. So unmoeglich es auch schien, verhielt sich dieser planet, trotz seines gewaltigen Umfanges, wie ein Leiter von beschraenkten Dimensionen. Die ungeheure Bedeutung dieser Tatsache fuer die Uebertragung von Energie nach meinem System war mir schon ganz klar geworden.

den. Nicht nur war es moeglich, ohne Draht telegraphische Botschaften nach irgendeiner Entfernung zu senden, was ich schon vor langer Zeit erkannt hatte, sondern auch die schwachen Modulationen der menschlichen Stimme konnten der ganzen Erdkugel aufgepraegt werden, und vielmehr noch, man konnte Kraft in unbegrenzten Quantitaeten auf jede beliebige irdische Entfernung und fast ohne Verlust uebertragen.

Mit diesen erstaunlichen Moeglichkeiten in Aussicht, mit dem experimentellen Beweise vor mir, dass ihre Verwirklichung von nun an nur eine Frage von Fachkenntnis, Geduld und Geschicklichkeit war, nahm ich die Entwicklung meines Sendemultiplikators kraeftig in Angriff, jetzt jedoch nicht so sehr mit der urspruenglichen Absicht, einen solchen von grosser Kraft zu erzeugen, sondern vielmehr zu dem Zwecke, den besten konstruieren zu lernen. Dies ist im Wesentlichen ein Stromkreis sehr hoher Selbstinduktion und geringen Widerstandes, den man wol einem typischen, in der Telegraphie mit Hertz'schen oder elektromagnetischen Wellen benutzten Stromkreise als gerade entgegengesetzt bezeichnen kann. Es ist schwer, sich von der wunderbaren Kraft dieser eigenartigen Vorrichtung einen Begriff zu machen. Da die elektromagnetischen Strahlungen auf eine unbedeutende Quantitaet herabgesetzt und richtige Resonanzverhaeltnisse aufrecht erhalten werden, wirkt der Stromkreis wie ein ungeheures Pendulum, indem er die primaeren Erregerimpulse unbegrenzt aufspeichert und der Erde und ihrer leitenden Atmosphaere gleich-

foermige harmonische Schwingungen aufpraegt, deren Intensitaeten, wie wirkliche Versuche gezeigt haben, so weit getrieben werden koennen, dass sie diejenigen, welche bei der natuerlichen Entfaltung statischer Elektrizitaet erreicht werden, uebertreffen.

Gleichzeitig mit diesen Bestrebungen wurden auch die Mittel der Individualisierung und Absonderung der Energie allmaechlich verbessert. Grosse Wichtigkeit wurde dieser Arbeit beigemessen, denn es fand sich, dass einfaches Abstimmen nicht hinreichte, um den strengen praktischen Erfordernissen gerecht zu werden. Die fundamentale Idee, zum Zwecke der Absonderung der uebertragenen Energie eine Anzahl absonderlicher, kooperativ vereinigter Elemente anzuwenden, fuehre ich direkt auf meine Lektuere von Spencer's klarer und anregender Auslegung des menschlichen Nervenmechanismus zurueck. Welchen Einfluss dieses Prinzip auf die Uebertragung von Intelligenz und elektrischer Energie im Allgemeinen haben wird, kann jetzt noch nicht abgeschaezt werden, denn die Kunst ist noch im Keimzustand; aber die gleichzeitige Uebermittlung von tausenden von telegraphischen oder telephonischen Botschaften durch einen einzigen Leitungskanal, sei er natuerlich oder kuenstlich, ohne gefaehrliche gegenseitige Stoerung, ist gewiss ~~tunlich~~ ^{moeglich}, waehrend Millionen moeglich sind. Andererseits kann durch Anwendung einer grossen Anzahl kooperativer Elemente und willkuerliche Abaenderung ihrer absonderlichen Eigenschaften und ihrer Reihenfolge ~~langen~~ ein beliebiger Grad der Individualisierung erreicht werden. Aus augenscheinli-

chen Gruenden wird dieses Prinzip auch fuer die Erweiterung der Uebertragungsentfernung von Wert sein.

Der Fortschritt, obgleich notwendigerweise langsam, war bestaendig und sicher, denn die Ziele, nach denen ich strebte, waren in der Richtung meiner fortwachrenden Studien und Taetigkeit. Es ist deshalb kein Wunder, dass ich schon vor Ende des Jahres 1899 die unternommene Aufgabe beendete und die Resultate erreichte, welche ich in meinem Artkel im Century Magazine vom Juni, 1900, in dem jedes Wort sorgfaeltig gewogen wurde, anzeigte.

Es ist schon viel getan, um mein System kommerziellem Gebrauch zur Verfuegung zu stellen, sowol zur Uebertragung von Energie in kleinen Quantitaeten fuer spezifische Zwecke, als auch auf industriellem Maassstabe. Die von mir erzielten Resultate haben meinen Plan der Intelligenzuebermittlung, fuer welche der Name "Welttelegraphie" vorgeschlagen worden ist, leicht ausfuehrbar gemacht. Das Prinzip ihrer Wirkung, die angewandten Mittel und ihre Anwendungsfahigkeiten bilden, glaube ich, eine radikale und fruchtbare Abweichung von dem, was vorher getan worden ist. Ich habe keinen Zweifel, dass sie sich fuer die Aufklaerung der Massen, besonders in noch uncivilisierten Laendern und schwer zugaenglichen Regionen, sehr wirksam erweisen, und dass sie zur allgemeinen Sicherheit, Bequemlichkeit und Wolsein, und der Aufrechterhaltung friedlicher Verhaeltnisse wesentlich beitragen wird. Sie bedingt die Anwendung einer Anzahl von Anlagen, welche alle imstande sind,

individualisierte Signale nach den äussersten Grenzen der Erde zu senden. Jede derselben wird vorzugsweise in der Nähe eines wichtigen Civilisationspunktes gelegen sein, und die Nachrichten, welche sie durch beliebige Mittel und Wege empfängt, werden nach allen Punkten der Erde geblixt. Eine billige und einfache Vorrichtung, die man in der Tasche tragen könnte, kann dann irgendwo auf See oder Land aufgestellt werden, und wird die Neuigkeiten der Welt, oder solche spezielle Depeschen, die fuer sie bestimmt sind, verzeichnen. Auf diese Weise wird die ganze Erde so zu sagen in ein riesiges Gehirn verwandelt werden, welches imstande ist, in jedem Teile die Mitteilungen aufzunehmen. Da eine einzige Anlage von nur hundert Pferdestärken hunderte Millionen von Instrumenten betätigen kann, wird das System ein tatsächlich unbegrenztes Arbeitsvermögen haben, und muss notwendigerweise die Uebermittlung von Intelligenz ungeheuer erleichtern und billiger machen.

Die erste dieser Centralanlagen wäre schon beendet, wenn sich nicht unvorhergesehene Verzögerungen eingestellt hätten, die jedoch glücklicherweise nichts mit dem rein technischen Charakter zu tun haben. Aber dieser Zeitverlust, obgleich verdriesslich, diente sich schliesslich doch als ein Segen in Verkleidung erweisen. Die beste mir bekannte Konstruktion ist gewählt worden, und der Sender wird einen Wellenkomplex von einer gesamten maximalen Aktivität von zehn Millionen Pferdestärken, von welcher ein Prozent reichlich genug ist, "die Erdoberfläche zu umgürten", von sich geben. Der Effekt dieser ungeheuren Energieabgabe, fast zweimal so

viel als die gesamten Niagaragefälle, kann nur durch Anwendung gewisser Kunstgriffe, die ich seiner Zeit bekannt machen werde, erzielt werden.

Für einen grossen Teil der Arbeit, die ich bis jetzt getan habe, habe ich der edlen Grossmutter Herrn J. Pierpont Morgan's zu verdanken, die um so willkommener und ermutigender war, weil sie zu einer Zeit gewährt wurde als diejenigen, die seitdem am meisten versprochen haben, die grössten Zweifler waren. Auch meinen Freund Stanford White muss ich für viele uneigennützig und wertvolle Hilfe danken. Diese Arbeit ist nun weit vorgeschritten, und wenn auch die Resultate verspätet sind, werden sie doch sicher kommen.

Die Uebertragung von Energie auf industriellem Maassstabe wird mittlerweile nicht vernachlässigt. Die Canadian Niagara Power Company hat mir ein vorzügliches Angebot gemacht, und eine fast eben so grosse Genugthuung als das Erringen von Erfolg der Kunst halber wird es mir verschaffen, ihre Konzession für sie finanziell vorteilhaft zu machen. In dieser ersten Kraftanlage, mit deren Entwurf ich seit langer Zeit beschäftigt bin, beabsichtige ich, zehn tausend Pferdekraft unter einer Spannung von hundert Millionen Volt, die ich jetzt mit Sicherheit erzeugen und ha^{ben} haben kann, zu verteilen.

Diese Energie wird überall auf der Erde gesammelt werden, vorzugsweise in kleinen Quantitäten, von einem Bruchteil einer bis

mehreren Pferdestaerken. Einer ihrer Hauptanwendungen wird die Beleuchtung vereinzelt gelegener Heimstaetten sein. Es ^{bedarf} ~~erfordert~~ sehr wenig Kraft, eine Wohnung mit Vakuumroehren, die von Hochfrequenzstroemen erregt werden, zu erleuchten, und in jedem Falle wird ein ein wenig ueber dem Dach erhobener Pol hinreichen. Noch ein wertvoller Gebrauch wird das Antreiben von Uhren und dergleichen Apparate sein. Diese Uhren werden ausserordentlich einfach sein, werden absolut keiner Wartung beduerfen und werden genau die richtige Zeit angeben. Die Idee der Erde amerikanische Zeit aufzupraegen ist bezaubernd und wird sehr wahrscheinlich populaer werden. Es giebt unzählbare Vorrichtungen aller Arten, die entweder jetzt im Gebrauch sind oder geliefert werden koennen, und indem ich sie auf diese Weise in Betrieb setze, duerfte ich imstande sein, mit einer Anlage von nicht mehr als zehn tausend Pferdestaerken der ganzen Welt eine grosse Kommoditaet zu bieten. Die Einfuehrung dieses Systems wird Gelegenheiten gewahren fuer Erfindung und Fabrikation, wie sie sich noch nie vorher dargeboten haben.

Da ich der weitreichenden Wichtigkeit dieses ersten Versuchs und dessen Einfluss auf zukuenftige Entwicklung gewaertig bin, werde ich langsam und sorgfaeltig zu Werke gehen. Erfahrung hat mich gelehrt fuer Unternehmungen, die nicht gaenzlich von meinen eigenen Faehigkeiten und Anstrengungen abhaengen, einen Termin festzusetzen. Aber ich bin voller Hoffnung, dass diese grossen Verwirklichungen nicht weit entfernt sind, und ich weiss dass, wenn dieses erste Werk vollendet ist, sie mit mathematischer Gewissheit folgen werden.

Wenn die grosse, zufaellig enthuelte und experimentell
bestaetigte Wahrheit voellig erkannt wird, dass dieser Planet, bei
all seiner erschreckenden Unermesslichkeit, fuer elektrische Strooe-
me tatsaechlich nichts mehr ist als eine kleine Metallkugel und
dass ~~infolge~~ dieser Tatsache die Verwirklichung vieler Moeglichkei-
ten, von denen jede der Einbildungskraft spottet und von unberechen-
barer Bedeutung ist, absolut sicher macht; wenn die erste Anlage in
Betrieb gesetzt und bewiesen wird, dass eine telegraphische Bot-
schaft, fast so geheim und unstoerbar wie ein Gedanke, auf irgend
eine irdische Entfernung uebertragen werden, dass der Schall der
menschlichen Stimme, mit allen ihren Intonationen und Modulationen,
getreu und augenblicklich an irgend einer andern Stelle der Erde
wieder erzeugt werden, dass die Energie eines Wasserfalles zur
Lieferung von Licht, Waerme und Triebkraft, irgendwo - auf See, oder
Land oder hoch oben in der Luft - verwendbar ~~gemacht~~ werden kann,
dann wird die Menschheit sein wie ein Ameisenhaufe, den man mit
einem Stock aufgeruehrt hat: Sehet die Aufregung die da kommt!

Tesla, Nikola
consulting engineer
I. W. Y. P. H.

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Tesla, Nikola
n.p., n.d.

3 visiting cards, two of Tesla (Consulting engineer, the Waldorf, and at the laboratory on East Houston Street) and one in Russian, inscribed "I. W. Y. P. H."

21380E

Nikola Tesla.
Consulting Engineer
and Electrician
Waldorf-Astoria
New York.

Nikola T.
Consulting Engineer
and Electrician

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Nikola Tesla,
New York, 1900
Invitation card of the Players Club,
signed by Tesla

R. H. Johnson
7 Lexington Ave
New York
City.

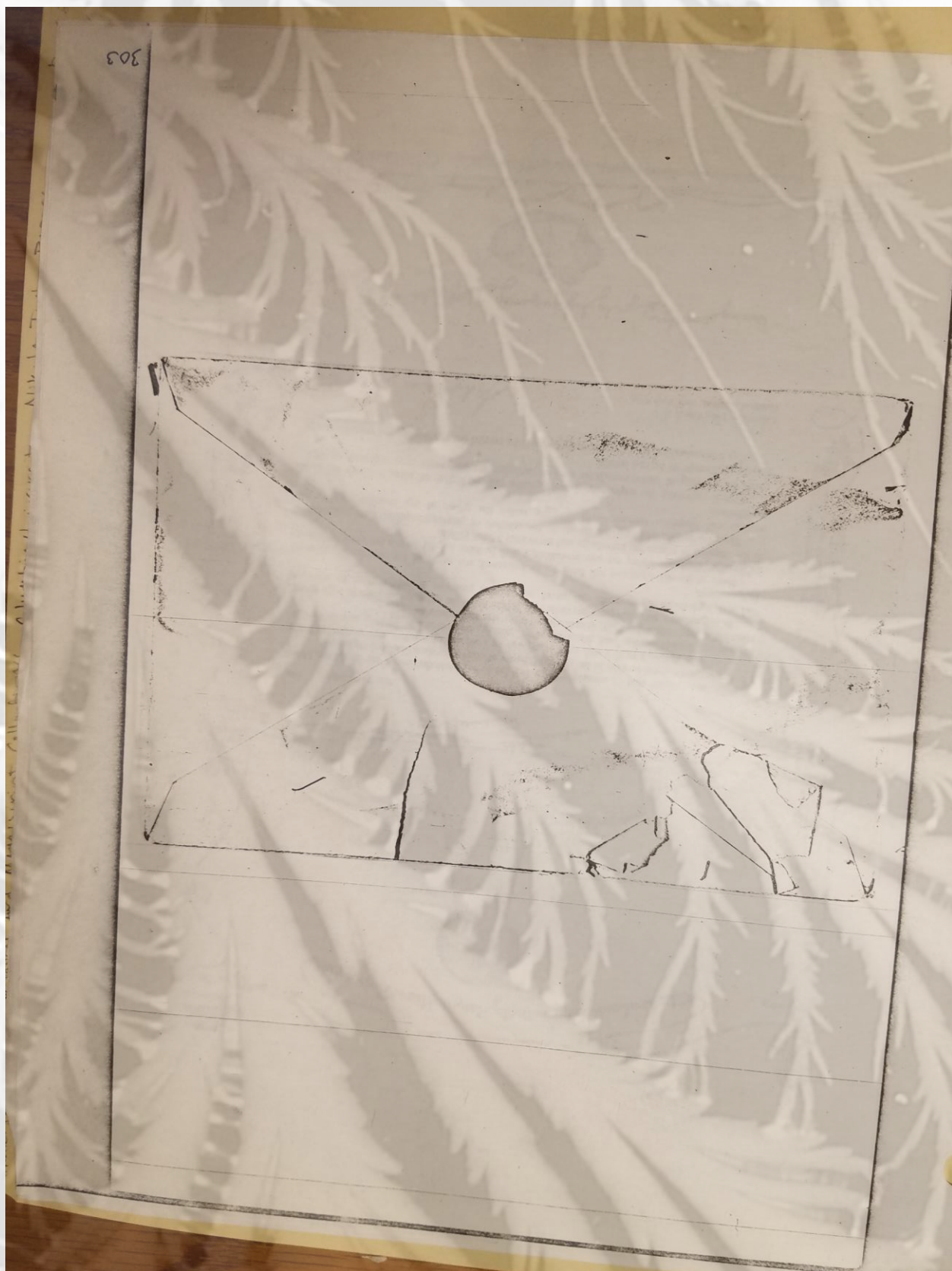
*May ladies fear not;
By all the laws of war you're privileged.*
Henry VIII, Act I, Scene II
The Players,
16 Gramercy Park.
The Players request the honor of your company on
the afternoon of Monday, April the twenty-third,
from two until six o'clock.
M
with compliments of Mr. Nikola Tesla
1900. *This card will admit one lady only
and must be signed by a member of the Club.*

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Tesla, Nikola
New York, 1 Jan. 1904
p.d.s., 3p. (announcement of his availability as consulting
electrician and engineer; facsimile signature; 2 copies
with envelope addressed to George Scharff and bearing Tesla's
wax seal)

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Mr. & Mrs. George Scherff



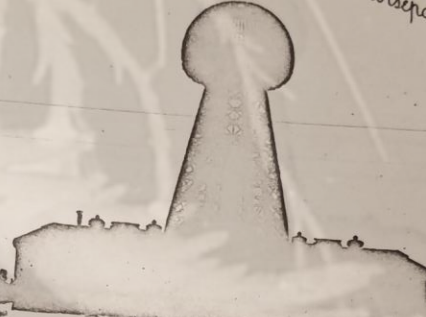


Inducting
Generator

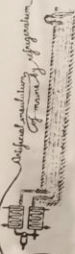


Inducting
Generator

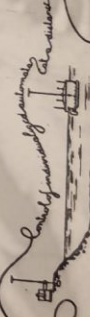
Electrical oscillator activity ten million horsepower



Over transmission
without wires



Inducting
Generator



Inducting
Generator

New York, January 1, 1904

I wish to announce that in connection with the commercial introduction of my inventions I shall render professional services in the general capacity of consulting electrician and engineer.

The near future, I expect with confidence, will be a witness of revolutionary departures in the production, transformation and transmission of energy, transportation, lighting, manufacture of chemical compounds, telegraphy, telephony and other arts and industries.

In my opinion, these advances are certain to follow from the universal adoption of high-potential and high-frequency currents and novel regenerative processes of refrigeration to very low temperatures.

Much of the old apparatus will have to be improved, and much of the new developed, and I believe that while furthering my own inventions, I shall be more helpful in this evolution by placing at the disposal of others the knowledge and experience I have gained.

Special attention will be given by me to the solution of problems requiring both expert information and inventive resource—work coming within the sphere of my constant training and predilection.

I shall undertake the experimental investigation and perfection of ideas, methods and appliances, the devising of useful expedients and, in particular, the design and construction of machinery for the attainment of desired results.

Any task submitted to and accepted by me, will be carried out thoroughly and conscientiously.

Laboratory, Long Island, N. Y.
Residence, Waldorf, New York City.

Nikola Tesla

Burning atmosphere nitrogen by high frequency discharge twelve million volts



Secure communication and multiplexing messages





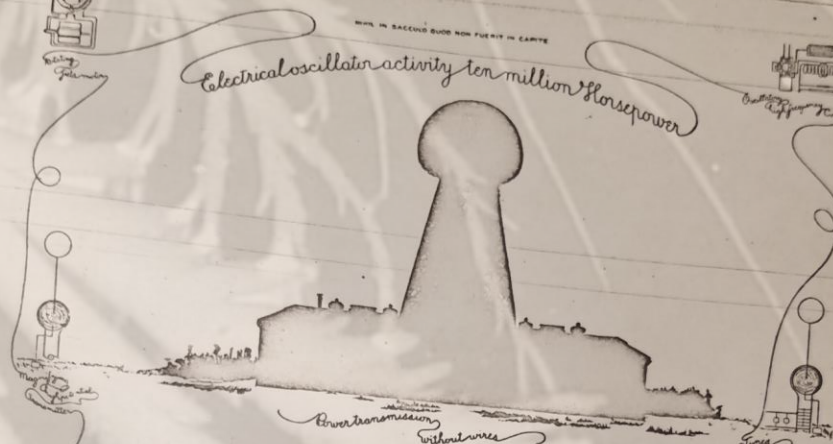
Self-portrait

WIRE IN BACK-ED BLUE NON-PURITY IN CANITE

Electrical oscillator activity ten million horsepower



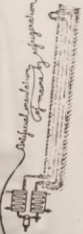
Overhead transmission



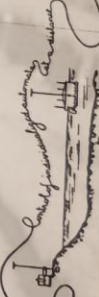
Overhead transmission without wires



Overhead transmission



Self-portrait



Self-portrait

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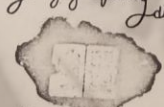
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Laboratory, Long Island, N. Y.
Residence, Waldorf, New York City.

Nikola Tesla

Burning atmosphere
Nitrogen by high frequency
discharges twelve million volts



Security from interference and multiplicity of messages



Self-portrait



Self-portrait

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1 - SOME CLIPPING

*"May ladies, fear not,
By all the laws of mine you're privileged."*

Henry VIII, Act 1, Scene 5.

The Players,

16 Gramercy Park.

*The Players request the honor of your company on
the afternoon of Monday, April the twenty third,
from two until six o'clock.*

M

with compliments of Nikola Tesla
1900.

*This card will admit one lady only
and must be signed by a member of the Club.*

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Nikola Tesla,
New York, 1900
Invitation card of the Players Club,
signed by Tesla

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and Manuscript Library (801 Butler Library) at the
completion of the reader's use.

Nikola Tesla, Esq.,

New York City.

May 10th, 1913.

Dear Mr. Tesla:-

I beg to acknowledge receipt of your letter of yesterday together with tax report of the Nikola Tesla Company for the year 1912, which I will forward with the Collector of Internal Revenue.

As regards your note for \$500.00, which I have not yet received, I have tried to have the same extended by the present but my efforts have met with opposition. If you could send me a check of the same amount, I would be glad to on account, I believe I could persuade the party concerned to make the same. Kindly let me know your decision in the matter as soon as possible, so that the note may not go to protest.

Respectfully yours,

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(Tesla, Nikola)
n.p., 10 May 1913
To Nikola Tesla
t.l., 1 p. (Carbon copy of a l.
Tesla's lawyer(?))

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PROSPECTUS FOR MR. TESLA'S NITRATES COMPANY.

Has involved a new and efficient process for

* Nikola Tesla, whose ~~discoveries~~ *discoveries* have formed the basis of so many ~~practical~~ *practical* applications of electricity, and which by ~~their~~ *their* world-wide recognition have given this inventor a pre-eminent position in the field of electricity, has, by a series of discoveries ~~and inventions~~ *and inventions* of the past year, and all of which are ~~now~~ *now* in the most advanced state of the art, ~~discovered~~ *discovered* the fixation of atmospheric nitrogen, ~~and~~ *and* its chemical combination with the oxygen of the ~~air~~ *air*, which, by its tremendous value and wide-reaching influence, bids fair to outrank many times his wonderful invention of the alternating current motor. ~~He has also discovered his own, and has discovered -~~ *(over)*

First, that his high-frequency electric discharges in the atmosphere give in a much more effective degree a peculiar electric chemical stress which brings about this most difficult of combinations; a stress which all workers in this field have recognized for years as being one which not only must be of tremendous power, but of almost infinite suddenness. The time element which has so materially interfered with the success of other workers in this field, has, by Mr. Tesla's invention, been almost entirely removed as an objection.

Second, Mr. Tesla's peculiar means of obtaining phenomenally high voltages (running into the millions of volts) from apparatus of most moderate dimensions enables him to obtain the

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**** & Their immeasurable suddenness, removes one great obstacle which has so materially interfered with the success of the old method and appliances.
& Tesla means for generating enormous electrical pressures with apparatus of ~~surprisingly~~ ^{very} small dimensions, available for production of discharges of arcs of the great length and volume so necessary to the highest efficiency.

His Plan means it is possible to operate units of any capacity, however great, to burn the arc at any desired rate and thus increase a thousand fold the effectiveness of the plant. The Torch apparatus may be likened to a turbine running at a stupendous speed, while that ~~one~~ ~~appliance~~ ~~for~~ ~~employed~~ is comparable to an old-fashioned engine turning slowly. For the same performance the latter is overpowered, more cumbersome and expensive. ~~The~~ ~~entire~~ ~~business~~ ~~on~~ ~~the~~ ~~part~~ ~~of~~ ~~the~~ ~~cost~~ ~~and~~ ~~for~~ ~~the~~ ~~charges~~

His has of vital importance to the enterprise reducing ^{the burden of} as it does, to a minimum the first cost and ~~the~~ ~~burden of~~ ~~the~~ ~~charges~~. To illustrate, ~~namely that~~ disregarding xx (other side)

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part ^{of the plant} ~~of the plant~~ subject to rapid ^{deterioration} ~~destruction~~; in fact, most of it is ^{good for one or two years} ~~good for one or two years~~; consists principally of brick ^{and metal and is good for centuries} ~~buildings, iron towers, brick or tile construction chambers and aqueducts~~ ^{or their equivalents}. The process is a continuous one and once started requires ^{little} ~~no~~ manual labor, ^{the electrical} ~~the electrical~~ continuing to burn the atmosphere into nitric fumes, which in turn combine with water to make nitric acid, and this goes on until the ~~current~~ ^{current} is switched off, and immediately recommences when ^{the} ~~the~~ current is ^{again} ~~again~~ switched on. There is no loss upon the discontinuing of the process for an hour, a day, a month or a year, ^{other than} ~~except~~ that ^{the} ~~the~~ due to plant lying idle and carrying ^{the small} ~~the small~~ interest. It is obvious, therefore, that it ^{is only necessary to start a process at a sufficiently} ~~is only necessary to start a process at a sufficiently~~ ^{reasonable} ~~reasonable~~ ^{by the use of this revolutionary process a cost} ~~can be built up~~ ^{can be built up} with a very reasonable investment of capital yielding annually a return many times the first cost.

The Tesla Nitrates Company owns the exclusive rights under the United States patents granted to ^{and} ~~the~~ Tesla, applicable to the manufacture of nitrates from the atmosphere, ^{which are the following:} ~~which are the following:~~ ^{It will be seen that} ~~It will be seen that~~ ^{the future is} ~~the future is~~ ^{improvement, he may make} ~~improvement, he may make~~ ^{to this subject} ~~to this subject~~ ^{and use for the benefit of his country and others.} ~~and use for the benefit of his country and others.~~ ^{It is proposed} ~~It is proposed~~ ^{to immediately make a demonstration of the} ~~to immediately make a demonstration of the ^{valuable advantages of the novel process with a model plant} ~~valuable advantages of the novel process with a model plant~~ ^{on the commercial scale in the immediate vicinity of New York} ~~on the commercial scale in the immediate vicinity of New York City, where experts and investors may see ^{for themselves} ~~for themselves~~ the practical application of ^{his} ~~these~~ inventions, ^{and judge for themselves of their value.} ~~in a full-sized unit~~ ^{apparatus.} ~~apparatus.~~ ^{In making this test, Mr. Tesla will have at his} ~~In making this test, Mr. Tesla will have at his ^{disposal, a plant that has already cost over \$200,000, a large} ~~disposal, a plant that has already cost over \$200,000, a large~~ ^{part of which will be immediately available.} ~~part of which will be immediately available.~~ ^{It is estimated that} ~~It is estimated that~~ ^{this test will involve an expenditure of \$25,000} ~~this test will involve an expenditure of \$25,000~~ ^{the cost} ~~the cost~~ ^{will be ample to meet} ~~will be ample to meet~~~~~~~~

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1. The additional apparatus, partly for attendance and
 all expenses of the Convention, and especially the plans for
 operation and partly for the very full and connected demonstration
 the important purpose of exhibiting the latest improvements
 in this direction it is proposed to be soon
 prior to their application on the large scale contemplated.

XXXX Tesla is now devoting himself to
 the perfection of plans for ~~the~~ a large collection
 being collected in this and by a ~~well known~~
 president of international affairs who has been for a long time
~~in Europe~~
 a long experience in the position of director
 by the old method and is thoroughly familiar
 with all ~~the~~ facts pertaining to the manufacture
 and sale of the products. In the near
 future X.K.

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3

the subject you wish to write about. In order to explain this phenomenon Einstein has invented the quantum "hambden"

My theory of gravitation explains this phenomenon perfectly

N.T. April 18, 1935

We need a great deal about the conversion of matter being changed into force and force being changed into matter by the cosmic rays. This is absurd. It is the same as saying that the body can be changed into the mind, and the mind into the body. We know that the mind is a functioning of the body, and in the same manner force is a function of matter. Without a body there can be no mind, without matter there can be no force.

Einstein has for years developed formulas explaining the mechanism of the cosmos. In doing this he overlooked an important factor, namely the fact, namely that some of the heavenly bodies are increasing in distance from the sun. This is the same as writing for one business letter and forgetting

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Teala, Nikola
born 15 Apr 1932
Teala relating to force and matter, to Einstein's theories, and Teala's own theory of gravitation

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DICKSON D. ALLEY,
FORMERLY OF TOWERS & CO.
ART PHOTOGRAPHER,
12 EAST 15TH STREET, NEAR 5TH AVENUE.

35

Paintings, &c., copied by the Isachromatic Process.

New York May 26 1903

Dear Mr. Alley,

Sorry I missed you. I want you to take two snaps at my place from the railroad track so that the chimney of the building is just in the center of frame. From previous photographs taken by one of my assistants it would seem that the best view would be obtained by placing the camera not quite on the end of the central path from railroad building but considerably closer to latter. The camera in my opinion should also be elevated considerably above ground, but this may not be necessary. Please when taking this principal view see that the doors of the building are wide open and the doors of the parlour window closed and that the house in front of parlour appears symmetrical with respect to door. Also observe that all the windows are down and that the workmen

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Tesla, Nikola
New York, 26 May 1903
To Dickson D. Alley
a.l.s., 2 p.

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Apr 1936

At the close of 1889, having worked one year in the shops of George Westinghouse, Pittsburgh, I experienced so great a longing for resuming my interrupted investigations that, notwithstanding a very tempting proposition by him, I left for New York to take up my laboratory work. But owing to pressing demands by several foreign scientific societies I made a trip to Europe where I lectured before the Institution of Electrical Engineers and Royal Institution in London and the Societe de Physique in Paris. After this and a brief visit to my home in Yugoslavia I returned to this country in 1892 eager to devote myself to the subject of predilection of my thoughts: the study of the universe.

During the succeeding two years of intense concentration I was fortunate enough to make two far-reaching discoveries. The first was a dynamic theory of gravity, which I have worked out in all details and hope to give to the world very soon. It explains the causes of this force and the motions of heavenly bodies under its influence so satisfactorily that it will put an end to idle speculations and false conceptions, as that of curved space. According to the relativists, space has a tendency to curvature owing to an inherent property or presence of celestial bodies. Granting a semblance of reality to this fantastic idea, it is still self-contradictory. Every action is accompanied by an equivalent reaction and the effects of the latter are directly opposite to those of the former.

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Supposing that the bodies act upon the surrounding space causing curvatures of the same, it appears to my simple mind that the curved spaces must react on the bodies and, producing the opposite effects, straighten out the curves. Since action and reaction are co-existent, it follows that the supposed curvature of space is entirely impossible. But even if it existed it would not explain the motions of the bodies as observed. Only the existence of a field of force can account for them and its assumption dispenses with space curvature. All literature on this subject is futile and destined to oblivion. So are also all attempts to explain the workings of the universe without recognizing the existence of the ether and the indispensable function it plays in the phenomena.

My second discovery was a physical truth of the greatest importance. As I have searched the scientific records in more than a half dozen languages for a long time without finding the least anticipation, I consider myself the original discoverer of this truth, which can be expressed by the statement: There is no energy in matter other than that received from the environment. On my 79th birthday I made a brief reference to it, but its meaning and significance have become clearer to me since then. It applies rigorously to molecules and atoms as well as to the largest heavenly bodies, and to all matter in the universe in any phase of its existence from its very formation to its ultimate disintegration.

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Being perfectly satisfied that all energy in matter is drawn from the environment, it was quite natural that when radioactivity was discovered, in 1896 I immediately started a search for the external agent which caused it. The existence of radioactivity was positive proof of the existence of external rays. I had previously investigated various terrestrial disturbances affecting wireless circuits but none of them or any others emanating from the earth could produce a steady sustained action and I was driven to the conclusion that the activating rays were of cosmic origin. This fact I announced in my papers on Roentgen rays and Radiations contributed to the Electrical Review of New York, in 1897. However, as radioactivity was observed equally well in other widely separated parts of the world, it was obvious that the rays must be impinging on the earth from all directions. Now, of all bodies in the Cosmos, our sun was most likely to furnish a clue as to their origin and character. Before the electron theory was advanced, I had established that radioactive rays consisted of particles of primary matter not further decomposable, and the first question to answer was whether the sun is charged to a sufficiently high potential to project such particles and produce the effects noted. This called for a prolonged investigation which culminated in my finding that the sun's potential was 216 billions of volts and that all such large and hot heavenly bodies emit cosmic rays. Through

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Further solar research and observation of Novae this has been proved conclusively, and to deny it would be like denying the light and heat of the sun. Nevertheless, there are still some doubters who prefer to shroud the cosmic rays in deep mystery. One of them declared recently that they must come from very remote regions in which matter is converted into energy. I am sure that this is not true for there is no place where such a process occurs in this or any other universe beyond our ken.

A few words will be sufficient in support of this contention. The kinetic and potential energy of a body is the result of motion and determined by the product of its mass and the square of velocity. Let the mass be reduced, the energy is diminished in the same proportion. If it be reduced to zero the energy is likewise zero for any finite velocity. In other words, it is absolutely impossible to convert mass into energy. It would be different if there were forces in nature capable of imparting to a mass infinite velocity. Then the product of zero mass with the square of infinite velocity would represent infinite energy. But we know that there are no such forces and the idea that mass is convertible into energy is rank nonsense.

While the origin and character of the rays observed near the earth's surface are sufficiently well ascertained, the so-called cosmic rays observed at great altitudes presented

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a riddle for more than 26 years, chiefly because it was found that they increased with altitude at a rapid rate. My investigations have brought out the astonishing fact that the effects at high altitudes are of an entirely different nature, having no relation whatever to cosmic rays. These are particles of matter projected from celestial bodies at very high temperature and charged to enormous electric potentials. The effects at great elevations, on the other hand, are due to waves of extremely small lengths produced by the sun in a certain region of the atmosphere. This is the discovery which I wish to make known. The process involved in the generation of the waves is the following: The sun projects charged particles constituting an electric current which passes through a conducting stratum of the atmosphere approximately 10 kilometers thick enveloping the earth. That is a transmission of energy exactly as I illustrated in my experimental lectures in which one end of a wire is connected to an electric generator of high potential, its other end being free. In this case the generator is represented by the sun and the wire by the conducting air. The passage of the solar current involves the transference of electric charges from particle to particle with the speed of light, this resulting in the production of extremely short and

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penetrating waves. As the air stratum mentioned is the source of the waves it follows that the so-called cosmic rays observed at great altitudes must increase as this stratum is approached. My researches and calculations have brought to light the following facts in this connection: (1) the intensity of the so-called cosmic rays must be greatest in the zenithal portion of the atmosphere; (2) the intensity should increase more and more rapidly up to an elevation of about 20 kilometers where the conducting air stratum begins; (3) from there on the intensity should fall, first slowly and then more rapidly, to an insignificant value at an altitude of about 50 kilometers; (4) the display of high potential must occur on the free end of the terrestrial wire, that is to say, on the side turned away from the sun. The current from the latter is supplied at a pressure of about 216 billion volts and there is a difference of 2 billion volts between the illuminated and the dark side of the globe. The energy of this current is so great that it readily accounts for the aurora and other phenomena observed in the atmosphere and at the earth's surface.

For the time being I must content myself with the announcement of the salient facts, but in due course I expect to be able to give more or less accurate technical

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data relating to all particulars of this discovery.

To go to another subject, I have devoted much of my time during the year past to the perfecting of a new small and compact apparatus by which energy in considerable amounts can now be flashed through interstellar space to any distance without the slightest dispersion. I had in mind to confer with my friend George E. Hale, the great astronomer and solar expert, regarding the possible use of this invention in connection with his own researches. In the meantime, however, I am expecting to put before the Institute of France an accurate description of the devices with data and calculations and claim the Pierre Curie Prize of 100,000 francs for means of communication with other worlds, feeling perfectly sure that it will be awarded to me. The money, of course, is a trifling consideration, but for the great historical honor of being the first to achieve this miracle I would be almost willing to give my life.

My most important invention from a practical point of view is a new form of tube with apparatus for its operation. In 1896 I brought out a high potential targetless tube which I operated successfully with potentials up to 4 million volts from '96 to '98. This device was adopted by many imitators

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and with slight modifications it is employed even now in all research laboratories and scientific institutions here and in other countries, and virtually all atomic investigations are carried on with it. At a later period I managed to produce very much higher potentials up to 18 million volts, and then I encountered unsurmountable difficulties which convinced me that it was necessary to invent an entirely different form of tube in order to carry out successfully certain ideas I had conceived. This task I found far more difficult than I had expected, not so much in the construction as in the operation of the tube. For many years I was baffled in my efforts, although I made a steady slow progress. Finally though, I was rewarded with complete success and I produced a tube which it will be hard to improve further. It is of ideal simplicity, not subject to wear and can be operated at any potential, however high, that can be produced. It will carry heavy currents, transform any amount of energy within practical limits, and it permits easy control and regulation of the same. I expect that this invention, when it becomes known, will be universally adopted in preference to other forms of tubes, and that it will be the means of obtaining results undreamed of before. Among others, it will enable the production of cheap radium substitutes in any desired quantity and will be, in general, immensely more effective in the smelting of

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atoms and the transmutation of matter. I am hopeful that it will be possible by its use to carry out a process in which there should be no misses whatever, but only hits. However, this tube will not open up a way to utilize atomic or sub-atomic energy for power purposes. According to the physical truth I have discovered there is no available energy in atomic structures, and even if there were any, the input will always greatly exceed the output, precluding profitable, practical use of the liberated energy.

Some papers have reported that I had promised to give a full description of my tube and its accessories on the present occasion. This has caused me considerable annoyance, and, owing to some obligations I have undertaken regarding the application of the tube for important purposes, I am unable to make a complete disclosure now. But as soon as I am relieved of these obligations a technical description of the device and of all the apparatus will be given to scientific institutions.

There is one more discovery which I want to announce at this time, consisting of a new method and apparatus for the obtaining of vacua exceeding many times the highest heretofore realized. I think that as much as one-billionth of a micron can be attained. What may be accomplished by means of such vacua is a matter of conjecture, but it is obvious that they will make possible the production of much more intense

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effects in electron tubes. My ideas regarding the electron are at variance with those generally entertained. I hold that it is a relatively large body carrying a surface charge and not an elementary unit. When such an electron leaves an electrode of extremely high potential and in very high vacuum it carries an electrostatic charge many times greater than the normal. This may astonish some of those who think that the particle has the same charge in the tube and outside of it in the air. A beautiful and instructive experiment has been contrived by me showing that such is not the case, for as soon as the particle gets out into the atmosphere it becomes a blazing star owing to the escape of the excess charge. The great quantity of electricity stored on the particle is responsible for the difficulties encountered in the operation of certain tubes and the rapid deterioration of the same.

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THE NEW TESLA ELECTRIC HEATER

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This device is greatly superior to the usual flat core type in efficiency and other respects. It consists of a thin polished metal tube acting as reflector and a base equipped with switch and connecting terminals and carrying spaced resistor wires concentric with the tube and at a certain distance from the inner surface of the same. In this arrangement the diffuse radiation is virtually eliminated, and the heater operates as if the resistor were not present, the rays being projected from the reflector radially to the central or focal region occupied by the boiling pot.

The principal advantages thus secured are the following:

1. A very high efficiency, as much as 96% being attainable.
2. The efficiency is practically the same whether the pot is large or small since the density of the rays is inversely as the diameter of the vessel.
3. Due to these features the current consumption is hardly more than half of that in the best heaters of the type referred to.
4. The resistor has a relatively much longer life and can be made to last almost indefinitely in some cases. Also less wire can be used if desired.
5. The heat being largely confined to the range, the kitchen remains comparatively cool.
6. Another practical advantage is greater safety from a variety of accidents frequently occurring with ordinary ranges.
7. The new heater is especially adapted for use on shipboard, Pullman cars, aerial vehicles and automobiles.
8. Likewise, it is suitable for all kinds of service on the table, being free from the objections of the present type.
9. It saves considerable time in certain applications.
10. Owing to simplicity, the cost of manufacturing is low.

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The New Tesla Electric Heater
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Seventh Chapter.

What my uncle Herse said and what my ~~uncle~~ Herse was; and why Fritz Schlimm had to whistle.

When the watchman was taken down the castle hill, Fritz Schlimm had, of course, gone along, only in order to see how the thing became the prisoner and if he would not perhaps escape, but the latter did not come to pass. The procession moved slowly down to the town-hall, for it had to wind its way from lastely through all sorts of towns and w. o. n. n. which had been collected from the villagers and the town for the transportation of baggage and booty and were now drifting to enter in the castle-court and on the road to the castle and surrounded by Frenchmen, that they might not gain escape, for the old farmers were already devilish smart ^{at} this ~~game~~ ^{game}. - The watchman went along with his two guardians, patient as a lamb and also perfectly calm, for though he had been greatly frightened at first and although the whole affair of last night was very disagreeable and serious for him, during the examination which the adjutant had instituted with him he had come into a frame of mind, which might be described as: "Yes, you talk and You may say a great deal before a word of it will please me", and his answers had turned out very shrewd. And although he had not in him that wild courage which in a lately been for everything, he had already been too long in the world and been in a scrape so often, that he did not immediately despair. He let things come as

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they may. "I wonder how this is going to ~~end~~ ^{end}" he said to himself, when he was pushed into the door of the town-hall. -

"Fritz Sahlmann", said ~~the~~ ^{alderman} ~~man~~ ^{herse} to the ~~top~~ ^{top}, when he wanted to go up to the council again, "what does this mean?" - Fritz Sahlmann tells with the greatest importance the story of yesterday, and that Mr. Drei had slept in Hanselle Westphalian's room and had broken up everything and how he himself had dropped and broken the chief-magistrate's pipe, - but he could not help it, it was Eiken's fault - and that the colonel had wanted to stick the chief magistrate and how Hanselle Westphalian was sitting in the kitchen, a picture of despair; but about the lump of ice he said nothing.

Now my uncle, ~~the~~ ^{alderman} ~~man~~ ^{herse}, was intensely patriotic, even if only in secret. And that had its reason. For as he whispered to me long years afterwards, when Bonaparte was already dead, he used to belong at this time to the League of Virtue. And I do believe him, because when he was in company he would always play with a long watch chain of very light hair - and Fritz Herse's was black - and he would always show a dangerously big iron ring finger ring, with which he had one time almost beaten that wicked Huepner, a journeyman locksmith, to death, when he had behaved in a very impolite manner in the court room. - "Fritz", he said to me later, "this pair is from a French soldier, who was thirteen and

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her head shorn for the fatherland, and this iron ring has cost me my gold one. But do not speak of it, I do not like it." Therefore he was at the time when this story happened, with good reason such for secrecy. It is possible, too, that his way and manner of looking over everything together from a distant point of view had much to do with his leaning towards secrecy, for while my father had to harass himself day and night with the most trifling drudgery and toil, in order that the little old nobody community of it barely remain hanging together and would close to pieces miserably entirely, ~~Herse~~ ^{alderman} Herse would let Kotonow march to the right and Czernitzew to the left, praise him and shield about - below, he did not understand his business, for he should not have moved to Berlin, but to the right as far as Stettin and rushed into Hornpartels flank. In short, he was just the right sort of a man to turn a sneeze into a thunderclap: in every innocent French corporal he saw a Corsican tyrant, and on some blue Monday at a veritable row constable Luth had received a few blows too, then he would carry on, - if the Duke of Lesclapure had been treated to a slap in the face.

"Hold your tongue, boy!" ^{alderman} Herse whispered very seriously, "do you want to spit out your death sentence in the public market place? - For the witness's life I would not give a single crochard, because it is certain that the killer and his Frederick have killed the chamberlain ..." - "Not the killer", Fritz

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THE NEW TESLA-ELECTRIC HEATER.

STRICTLY CONFIDENTIAL.

This device is greatly superior to the usual flat coil type in efficiency and other respects. It consists of a thin polished metal tube acting as reflector and a case equipped with switch and connecting terminals and carrying spaced resistor wires concentric with the tube and at a certain distance from the inner surface of the same. In this arrangement the diffuse radiation is virtually eliminated and the heater operates as if the resistor wires were present, the rays being projected from the surface radially to the central or focal region comprised by the boiling pot.

The principal advantages thus secured are the following:

1. A very high efficiency, as much as 90% being attainable.

2. The efficiency is practically the same whether the pot be large or small since the density of the rays is inversely as the diameter of the vessel.

3. Due to this property the current consumption

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is hardly more than half of that in the best heaters of the type referred to.

4. The resistor has a relatively much longer life and can be made to last almost indefinitely in some cases, while low wire can be used if desired.

5. The heat being largely confined to the range, the kitchen remains comparatively cool.

6. Another practical advantage is greater safety from a variety of accidents frequently occurring with ordinary ranges.

7. The new heater is especially adapted for use on shipboard, Pullman cars, aerial vehicles and automobiles.

8. Likewise, it is suitable for all kinds of service on the land, being free from the objections of the present heaters.

9. It saves considerable time in certain applications.

10. Owing to simplicity the cost of manufacture is low.

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is nearly more than half of that in the best heaters of the type referred to.

4. The resistor has a relatively much longer life and can be made to last almost indefinitely in some cases. Silver base wire can be used if desired.

5. The heat being largely confined to the range, the kitchen remains comparatively cool.

6. Another practical advantage is greater safety from a variety of accidents frequently occurring with ordinary ranges.

7. The new heater is especially adapted for use on shipboard, balloon cars, aerial vehicles and automobiles.

8. Likewise, it is suitable for all kinds of service on the land, being free from the objection of the present heaters.

9. It saves considerable time in certain applications.

10. Owing to simplicity the cost of manufacture is low.

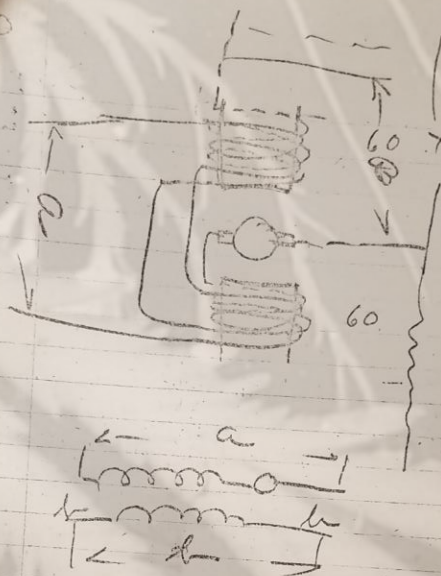
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Wind field coils with two wires - winding both at the same time. One set of field windings to be connected in series, see circuit A, and two terminals brought out. The other set of field windings should be connected in series with the armature, see circuit B. set circuit to take 1/2 ampere or 60 volts.

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New York, Apr. 19th, 1906.

Mr. Nicholas Tesla,
Waldorf Astoria, C I T Y.

Dear Sir:-

We have your favor of the 16th inst., which confirms telephone instructions to ship to you 2500 ft. of #8 B&SG. rubber insulated and lead covered cable.

Please note we are giving this order best attention in accordance with our quotation of April 16th.

Very respectfully,

ELW/H

STANDARD UNDERGROUND CABLE CO.

J. M. Smith
General Manager
New York, N. Y.

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MECHANICAL THERAPY

BY

NIKOLA TESLA

In order to convey a clear idea of the significance and revolutionary character of this discovery it is indispensable to make a brief statement regarding MECHANICAL THERAPY.

Fifty years ago, while investigating high frequency currents developed by me at that time, I observed that they produced certain physiological effects offering new and great possibilities in medical treatment. My first announcement spread like fire and experiments were undertaken by a host of experts here and in other countries. Then a famous French physician, Dr. D'Arsonval, declared that he had made the same discovery, a heated controversy relative to priority was started. The French, eager to honor their countryman, made him a member of the Academy, ignoring entirely my earlier publication. Resolved to take steps for vindicating my claim, I went to Paris, where I met Dr. D'Arsonval. His personal claim disarmed me completely and I abandoned my intention, content to rest on the record. It shows that my disclosure antedated his and also that he used my apparatus in his demonstrations. The final judgment is left to posterity.

Since the beginning, the growth of the new art and industry has been phenomenal, some manufacturers turning out daily hundreds of sets. Many millions are now in use throughout the world. The currents furnished by them have proved an ideal tonic for the human nerve system. They promote heart action and digestion, induce healthful sleep, rid the skin of destructive exudations and cure colic and fever by the warmth they create. They vivify atrophied or paralyzed parts of the body, allay all kinds of suffering and save annually thousands of lives. Leaders in the profession have assured me that I have done more for humanity by this medical treatment than by all my other discoveries and inventions. Be that as it may, I feel certain that the MECHANICAL THERAPY, which I am about to give to the world, will be of incomparably greater benefit. Its discovery was made accidentally under the following circumstances.

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Mechanical Therapy
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- 2 -

I had installed at the laboratory, 35 South Fifth Avenue, one of my mechanical oscillators with the object of using it in the exact determination of various physical constants. The machine was bolted in vertical position to a platform supported on elastic cushions and, when operated by compressed air, performed minute oscillations absolutely isochronous, that is to say, consuming rigorously equal intervals of time. So perfect was its functioning in this respect that clock driven by it indicated the hour with astronomical precision. One day, as I was making some observations, I stepped on the platform and the vibrations transmitted to it by the machine were transmitted to my body. The sensation experienced was as strange as approachable, and I asked my assistants to try. They did so and were gratified and pleased like myself. But a few minutes later some of us, who had stayed longer on the platform, felt an unpleasant and pressing necessity which had to be promptly satisfied, and then a stupendous truth dawned upon me. Evidently, these isochronous rapid oscillations stimulated powerfully the peristaltic movements which propel the food-stuffs through the alimentary channels. A means was thus provided whereby their contents can be perfectly regulated and controlled at will, and without the use of drugs, specific remedies or internal applications whatever.

When I began to practice with my assistants MECHANICAL THERAPY we used to finish our meals quickly and rush back to the laboratory. We suffered from dyspepsia and various stomach troubles, biliousness, constipation, flatulence and other disturbances, all natural results of such irregular habit. But after only a week of application, during which I improved the technique and my assistants learned how to take the treatment to their best advantage, all these forms of sickness disappeared as by enchantment and for nearly four years, while the machine was in use, we were all in excellent health. I cured a number of people, among them my great friend

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Mark Twain whose books saved my life. He came to the laboratory in the worst shape suffering from a variety of distressing and dangerous ailments but in less than two months he regained his old vigor and ability of enjoying life to the fullest extent. Shortly after, a great calamity befall me: my laboratory was destroyed by fire. Nothing was insured and the loss of priceless apparatus and records gave me a terrific shock from which I did not recover for several years. The enormous dis-continuance of MECHANICAL THERAPY also caused me deep regret. I had evolved a wonderful remedy for ill of inextinguishable value to mankind and in-vented apparatus offering unbounded commercial possibilities but when I came to consider practical introduction I realized that it was entirely unfeasible. It was big, heavy and noisy, called for a continuous supply of oil, part of which was discharged in the room as fine spray; it consumed considerable power and required a number of ob-jectious accessories. During the succeeding years I made great improvements and finally evolved a design which leaves nothing to be desired. The machine will be very small and light, operate noise-lessly without any lubricant, consume a trifling amount of energy and will be, to my knowledge, the most beautiful device ever put on the market. The intention is to exhibit it in action at the occasion of my annual reception in honor of the Press which has been, unfortunately, delayed this year, and I anticipate that it will elicit great interest and receive wide publicity. Unless I am grossly mis-taken it will be introduced very extensively and, eventually, there will be one in every household.

The practical application of MECHANICAL THERAPY through my oscillators will profoundly affect human life. By insuring perfect regularity of evacua-tions the body will function better in every respect

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New York, n.d.



- 4 -

and life will become ever so much safer and more enjoyable. One of the most important results will be the great reduction -- amounting possibly to seventy-five per cent -- in the number of heart failures, which are mostly caused by some acute upset of the digestive process and normal operation of the stomach. Another vital improvement will be derived from the quickened removal of toxic excretions of organs affected by disease. It is reasonable to expect that through this and other healthful actions ulcers and similar internal lesions or abscesses will be cured and relief might be obtained even in case of a cancer or other malignant growth. Skilled physicians and surgeons will be able to perform veritable miracles with such oscillations. They stimulate strongly the liver, spleen, kidneys, bladder and other organs and by these desirable actions they must contribute not a little to well being. Persons suffering from anemia of any form will be especially helped by the treatment. But the greatest benefit will be derived from it by women who will be able to reduce without the usual tantalizing abstinence, privation, sacrifice of time and money and torture they have to endure. They will improve much in appearance, acquire clear eyes and complexions and it may be safely predicted that long continued treatment will bring forth feminine beauty never seen before. It is not to be forgotten that the elimination of countless drugs, patent medicines and specific remedies of all kinds taken internally, by which millions of people doom themselves to an early grave, will be of much good to humanity.

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WALTER FRANK SPERRY,
COMMISSIONER
Telephone, 371 Cortlandt.

State of New York.
Comptroller's Office.

OFFICE OF
CORPORATION TAX COMMISSIONER,
257 Broadway, New York City.

New York.

Rec 7/6/07

To *Nikola Tesla Co.*
Babylon D.D.
Waldorf Astoria Hotel City

Dear Sirs:--I am commissioned by the Comptroller of the State of New York to examine the above named Company relative to taxation.

This matter has been set down for hearing on the day of *Rec 7/6/07* 1907, at *11:30*. The President, Secretary or Treasurer, or, in their absence, the New York Manager of the Company, is required to appear for examination at that time. In case of failure to attend and give evidence in this matter, the company will be taxed, on the maximum amount, on information in possession of the department.

Revision of each assessment can be had at the office of this department in Albany, on proper application.

Respectfully yours,

Walter S. Sperry

Corporation Tax Commissioner.

JOSEPH GUARDENA.

RECORDED
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46 E. Houston Street March 23. 1900.

My dear Mr. Buell,

Many thanks for the tablets, I think they are good. As to the nose disease I have a horror of it such that I would rather go to Hades than to the Egyptian if it were at the price.

Selected forwarded article roasting my
illustrations friend Sir William Crookes who
is turning water into my mill. I would
drop the adjective - "distinguished" would not
do. Laker is mistaken, this is literary
style. Crookes is not distinguished, he
is illustrious.

I have not forgotten the text to be furnished or improved and finished for. And is for June of this or next year?

Please tell my friend Luke that I expect
to send it to him soon.

Dr. Teste

FROM COLLEGE PARK, MARYLAND
CAMP 31

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MR. TESLA SPEAKS OUT

Permit me a few words of comment relative to the World editorial of Oct. 25 in which I am directly concerned.

My work on the incandescent lamp and direct-current system of distribution was more like the performance of an extraordinarily energetic and determined pioneer than that of an inventor. It was prodigious in amount but not creative. The lamp itself, consisting of a carbon filament in an exhausted globe, was well known and even patented before Crookes had proposed incandescent conductors with leading-in platinum wires sealed in the glass and obtained extremely high vacua; the multiple-arc arrangement was frequently shown at institutions of learning, display windows and exhibitions with Geissler tubes; electric generators had been constructed, means for regulating current and voltage described, and canalization of electricity was as obvious as that of water, gas, compressed air or other commodity.

Irrespective of this, however, his primitive scheme of lighting was subject to fatal economic limitations and could have never proved a commercial success in competition. Indeed, during the past thirty-five years it has been almost wholly displaced by a more practical and efficient system based on my rotating magnetic field, a discovery which even hard-headed engineers and patent lawyers have declared to be "one of the greatest triumphs of the human mind." To convey an idea of the extent of its use I only need to quote Dr. B. A. Behrend, one of the foremost electrical experts, who in his book on the induction motor says: "Were we to eliminate from our industrial world the results of Mr. Tesla's work the wheels of industry would cease to turn, our electric trains and cars would stop, our towns would be dark, our mills dead and idle. So far-reaching is this work that it has become the warp and woof of industry."

Edison and his associates bitterly opposed the introduction of my system, raising a clamor against the "deadliness" of the alternating current, which proved very effective and led to the adoption of a commercial type of machines in the electrocution of criminals, an apparatus monstrously unsuitable for the poor wretches are not despatched in a merciful manner but literally rotated alive. To the observer their sufferings seem to be of short duration; it must be borne in mind, though, that an individual under such conditions, while wholly bereft of the consciousness of the lapse of time, retains a keen sense of pain, and a minute of agony is equivalent to that through all eternity.

Had the Edison companies not finally adopted my invention, they would have been wiped out of existence, and yet not the slightest acknowledgment of my labors has ever been made by any of them, a most remarkable instance of the proverbial unfairness and ingratitude of corporations. But the reason is not far to seek. One of their prominent men told me that they are spending \$10,000,000 every year to keep Edison's name before the public, and he added that it is worth more to them.

Of course, in all that unceasing and deafening shouting from the housetops any voice raised to apprise people of the real state of things is like the chirp of a little sparrow in the roar of Niagara. So it comes that very few have a clear idea of the situation.

In truth, my system has not only provided energy for all purposes throughout the world but also revolutionized electric lighting and made it a great commercial success by reducing the cost of power and increasing enormously the distance of transmission. The greater part of the \$80,000,000,000 which, according to President Hoover's statement, represented the value of electric business, can be traced to my system and its effect on the lighting and other industries. In view of this I feel that I also have done much to dispel darkness. Surely, my system is more important than the incandescent lamp, which is but one of the known electric illuminating devices and admittedly not the best. Although greatly improved through chemical and metallurgical advances and skill of artisans, it is still inefficient, and the glaring filament emits hurtful rays responsible for millions of bald heads and spoiled eyes. In my opinion, it will soon be superseded by the electrodeless vacuum tube which I brought out thirty-eight years ago, a lamp much more economical and yielding a light of indescribable beauty and softness. The technical resources of that time were inadequate to make it a practical success, but most of the difficulties will be overcome when cheap quartz glass becomes available.

No amount of praise is too much to bestow upon Edison for his vigorous pioneer work, but all he did was wrought in known and passing forms. What I contributed constitutes a new and lasting addition to human knowledge. Like his lamp, my induction motor may be discarded and forgotten in the continuous evolution of the arts, but my rotating field with its marvelous phenomena and manifestations of force will live as long as science itself.

NIKOLA TESLA

New York, Nov. 5.

COLUMBIA
UNIVERSITY
N.Y. WORLD
NOV-9, 1929

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C-4, 5

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Mr. Tesla Speaks Out

To the Editor of the World:

Permit me a few words of comment relative to your editorial of October 21st in which I am directly concerned.

Edison's work on the incandescent lamp and direct current system of distribution was more like the performance of an extraordinarily energetic and horse-sensed pioneer than that of an inventor; it was prodigious in amount, but not creative. The lamp itself, consisting of a carbon filament in an exhausted globe, was well known and even patented years before; Crookes had employed incandescent conductors with leading-in platinum wires sealed in the glass and obtained extremely high vacua; the multiple arc arrangement was frequently shown at institutions of learning, display windows and exhibitions with Geissler tubes; electric generators had been constructed, means for regulating current and voltage described and canalization of electricity was as obvious as that of water, gas, compressed air or other commodity. Irrespective of this, however, his primitive scheme of lighting was subject to fatal economic limitations and could have never proved a commercial success in competition. Indeed, during the past thirty-five years it has been almost wholly displaced by a more practical and efficient system based on my rotating magnetic field, a discovery which even hard-headed engineers and patent lawyers have declared to be "one of the greatest triumphs of the human mind." To convey an idea of the extent of its use, I only need to quote Dr B.A. Behrend, one of the foremost electrical experts, who in his book on the induction motor says: "Were we to eliminate from our industrial world the results of Mr Tesla's work, the wheels of industry would cease to turn, our electric trains and cars would stop, our towns would be dark, our mills dead and idle. So far-reaching is this work that it has become the warp and woof of industry."

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FROM
COLUMBIA
UNIVERSITY

TO NEW YORK
NOV. 5, 1929

38

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New York, November 5, 1927.

Nikola Tesla
No 8 West 40th St
N.Y.C.

10⁰⁰
10/62

New York, July 12th, 1900.

46 & 48 East Houston Street.

Rev. William E. Davenport,

Italian Mission,

29 Front Str., Brooklyn, N. Y.

Reverend Sir:-

In reply to your note to the Century Magazine, which has been forwarded to me through the courtesy of the Editor, I beg to say that I shall be at your service any time during the day, at my office, above address.

Yours respectfully,

N. Tesla

FROM
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card 32

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Es ist unmöglich Ihren hoflichen Ansuchen, ~~gemacht~~ bei
einer Gelegenheit ~~von so grosser Bedeutung~~ ^{So in der Vergangenheit} in den Leben Ihres Jour-
nals, zu widerstehn. Ihr Brief hat die Erinnerung an unsere begin-
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dienten Erfolge, ~~Gefalligkeiten~~ ^{Dienste} und Missverstaendnisse neu belebt.
~~Er hat die Grosse fruher Erwartungen, das schnelle Erfolge~~ ^{Auch schmerzliche} der
Zeit und, ~~weil~~ ^{leidet} die Kleinheit der Verwirklichungen ~~schwerlich~~
~~ins Gedachtnis gerufen.~~ Die folgenden Zeilen, welche, ~~wenn es~~
~~nicht wegen Ihrer Anregung, vielleicht eine lange Zeit der Oeffent-~~
~~lichkeit noch nicht uebergeben worden waeren, sind ein Anerbieten~~
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Gegen Ende des Jahres 1898 fuehrte mich eine systemati-
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eine Methode elektrischer Energieuebertragung durch das natuerliche
Medium zu vervollkommen, zu der Erkenntnis drei wichtiger Erfor-
dernisse: erstens, die Entwicklung eines Senders von grosser Kraft;
zweitens, die Vervollkommenung von Mitteln zur Individualisierung
und Absonderung der uebertragenen Energie; und, drittens, die Fest-
stellung der Gesetze der Fortpflanzung von Stroemen durch die Erde

DIE UEBERTRAGUNG ELEKTRISCHER ENERGIE OHNE DRAHT.

(Mitgeteilt an Electrical World and Engineer, 5 Maerz, 1904.)

Von Nikola Tesla.

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und die Atmosphäre. Verschiedene Gründe, von denen nicht der geringste die mir von meinem Freunde Leonard E. Curtis und der Colorado Springs Electric Company angebotene Hilfe war, bewogen mich, fuer meine experimentellen Untersuchungen das grosse Plateau, zwei tausend Meter ueber der Meeresflaeche, in der Naehة dieses reizenden Kurortes zu waehlen, welchen ich spaet im Mai 1899 erreichte. Kaum war ich einige Tage dort gewesen, als ich mich schon zu der gluecklichen Wahl gratulieren konnte, und ich begann die Aufgabe, fuer welche ich mich lange geschult hatte, mit dankbarem Sinne und voll begeisternder Hoffnung. Die vollkommene Reinheit der Luft, die unvergleichliche Schoenheit des Himmels, der erhabene Anblick einer hohen Gebirgskette - alles rund umher trug dazu bei, die Bedingungen fuer wissenschaftliche Beobachtungen ideal zu machen. Dazu kam noch der belebende Einfluss eines herrlichen Klimas und eine eigenartige Verschaeerfung der Sinne. Die Organe unterziehen sich in jenen Regionen merkblichen physikalischen Veraenderungen. Die Augen nehmen eine ausserordentliche Klarheit an, was die Sehkraft verbessert; die Ohren troeknen aus und werden empfindlicher gegen Schall. Man kann dort Gegenstaende auf soch grosse Entfernungen unterscheiden, dass ich vorziehe, diese von jemand anders nennen zu lassen, und ich habe - dies kann ich zu bezeugen wagen - sieben und acht hundert Kilometer weit entfernte Donnerschlaege gehoert. Ich haette sie auf noch groessere Entfernungen hoeren koennen, wenn es nicht langweilig gewesen waere, die Ankunft der Laute,

die nach bestimmten Zwischenräumen erfolgte, genau wie sie - fast eine Stunde im Voraus - von einem elektrischen Anzeigengerät angekündet wurde, zu erwarten.

In der Mitte des Monats Juni, während Vorbereitungen auf andere Arbeit vor sich gingen, stellte ich einen meiner Empfangstransformatoren auf in der Absicht, auf eine neue Weise, experimentell, das elektrische potentiell der Erdoberfläche zu bestimmen und dessen periodische und gelegentliche Schwankungen zu beobachten. Dies war ein Teil eines sorgfältig im Voraus entworfenen Planes. Eine höchst empfindliche, sich selbst wiederherstellende Vorrichtung, welche ein registrierendes Instrument kontrollierte, war in den sekundären Stromkreis eingeschaltet, während die Primäre mit der Erde und mit einem erhobenen Pol von regulierbarer Kapazität verbunden war. Die Variationen des Potentials verursachten elektrische Wogungen in der Primäre; diese erzeugten sekundäre Ströme, die wiederum auf die empfindliche Vorrichtung und den Registrator im Verhältnis zu ihrer Intensität einwirkten. Es stellte sich heraus, dass die Erde buchstäblich mit elektrischen Schwingungen belebt war, und bald war ich fast gänzlich in dieser interessanten Forschung vertieft. Bessere Gelegenheiten zu solchen Beobachtungen wie ich zu machen beabsichtigte konnten nirgends gefunden werden. Colorado ist ein Land, das wegen der Entfaltung naturlicher elektrischer Kraft berüchtigt ist. In der trockenen und verdünnten Atmosphäre scheint die Sonne mit grimmiger Intensität

auf die Gegenstände herab. Ich entwickelte Dampf bis auf einen gefährlichen Druck in mit konzentrierter Salzlosung gefüllten Faessern, und die Staniolaüberzüge einiger meiner erhitzten Pole schrumpften in der feurigen Glut zusammen. Ein experimenteller Hochspannungstransformator, der unvorsichtigerweise den Strahlen der untergehenden Sonne ausgesetzt worden war, wurde durch das Herausschmelzen der Isolationsmischung verderben. Die Trockenheit und Duernheit der Luft traegt dazu bei, dass das Wasser wie in einem Kessel verdampft, und statische Elektricität entwickelt sich in grosser Menge. Blitzentladungen sind demgemäss sehr Häufig und mitunter von unbegreiflicher Heftigkeit. Bei einer Gelegenheit fanden in zwei Stunden annähernd zwölf tausend Entladungen statt, und alle in einem Radius von gewiss weniger als fünfzig Kilometer vom Laboratorium. Viele derselben glichen riesenhaften Bäumen aus Feuer mit den Stämmen nach oben oder unten. Kugelblitze habe ich nicht gesehen, aber als Belohnung fuer meine Enttauschung gelang es mir spaeter, die Art ihrer Bildung zu bestimmen und sie kuenstlich zu erzeugen.

An Ende desselben Monats bemerkte ich mehrere Male, dass meine Instrumente durch Entladungen, die in grosser Entfernung stattfanden, staerker beeinflusst wurden, als durch solche in der Naehel. Das war fuer mich ein grosses Raetsel. Was war die Ursache? Eine Reihe von Beobachtungen bewies, dass es nicht von dem Unterschiede in der Intensitaet zwischen den einzelnen Entladun-

gen herrühren konnte, und ich stellte leicht fest, und ~~ich stellte~~
~~leicht fest~~, dass das Phänomen nicht das Resultat eines variieren-
den Verhältnisses zwischen den Perioden meiner Empfaengerstromkrei-
se und denen der irdischen Störungen war. Eines Abends, als ich
mit einem Assistenten hinging und ueber diese Erfahrungen nach-
sah, ueberwaeltigte mich ploetzlich ein Gedanke. Vor Jahren, als
ich ein Kapitel meines Vortrages vor dem Franklin Institute und
der National Electric Light Association schrieb, war er mir auch
eingefallen, aber ich hatte ihn als absurd und unmoeglich verworfen.
Ich verbannte ihn wieder. Mein Instinkt war jedoch nach gerufen,
und ich fuehlte irgendwie, dass ich mich einer grossen Offenbarung
naeherte.

Es war am dritten Juli - das Datum werde ich nie vergessen -
als ich den ersten entscheidenden, experimentellen Beweis einer
Wahrheit von ueberwaeltigender Wichtigkeit fuer den Fortschritt der
Menschheit erhielt. Eine dunkle, stark geladene Wolkenmasse sam-
melte sich im Westen. Gegen Abend brach ein heftiges Gewitter los,
welches, nachdem es einen beträchtlichen Teil seiner Gewalt in den
Bergen von sich gegeben hatte, mit grosser Geschwindigkeit ueber
die Ebene dahingejagt wurde. Dicke und lang anhaltende Bogen bil-
deten sich in fast regelmaessigen Zwischenraeumen. Meine Beobach-
tungen waren nun sehr erleichtert, und die schon gewonnenen Erfah-
rungen machten sie genauer. Ich war instande, meine Instrumente
schnell zu manipulieren und ich war vorbereitet. Da der Registrier-

apparat richtig adjustiert war, wurden seine Anschlaege mit der zunehmenden Entfernung des Gewitters schwaecher und schwaecher, bis sie gaenzlich aufhoerten. Ich beobachtete in begieriger Erwartung. Und wirklich, nach einer kleinen Weile fingen die Anschlaege wieder an, wurden staerker und staerker und, nachdem sie ein Maximum ueberschritten hatten, wurden sie allmaechlich schwaecher und hoerten wieder auf. Viele Male wiederholten sich dieselben Wirkungen in regelmaessig wiederkehrenden Zwischenraeumen bis der Sturm, der, wie einfache Berechnungen erwiesen, sich mit fast gleichmaessiger Geschwindigkeit bewegte, sich auf eine Entfernung von etwa dreihundert Kilometer zurueckgezogen hatte. Und auch dann liessen diese seltsamen Wirkungen noch nicht nach, sondern fuhren fort, sich mit unverminderter Staerke zu offenbaren. Spaeter wurden aehnliche Beobachtungen auch von meinem Assistenten, Herrn Fritz Loewenstein, gemacht, und kurz nachher boten sich mehrere vortreffliche Gelegenheiten dar, die das wirkliche Wesen des wunderbaren Phaenomens noch kraeftiger und unverkennbar an den Tag brachten. Es blieb kein Zweifel; Ich beobachtete stehende Wellen.

Indem die Quelle der Stoerungen sich fortbewegte, kam der Empfaengerstromkreis nacheinander auf ihre Knoten- und Bauchpunkte. So unmoeglich es auch schien, verhielt sich dieser planet, trotz seines gewaltigen Umfanges, wie ein Leiter von beschraenkten Dimensionen. Die ungeheure Bedeutung dieser Tatsache fuer die Uebertragung von Energie nach meinem System war mir schon ganz klar gewor-

den. Nicht nur war es möglich, ohne Draht telegraphische Botschaften nach irgendeiner Entfernung zu senden, was ich schon vor langer Zeit erkannt hatte, sondern auch die schwachen Modulationen der menschlichen Stimme konnten der ganzen Erdoberfläche aufgeprägt werden, und vielmehr noch, man konnte Kraft in unbegrenzten Quantitäten auf jede beliebige irdische Entfernung und fast ohne Verlust übertragen.

Mit diesen erstaunlichen Möglichkeiten in Aussicht, mit dem experimentellen Beweise vor mir, dass ihre Verwirklichung von nun an nur eine Frage von Fachkenntnis, Geduld und Geschicklichkeit war, nahm ich die Entwicklung meines Sendemultiplikators kräftig in Angriff, jetzt jedoch nicht so sehr mit der ursprünglichen Absicht, einen solchen von grosser Kraft zu erzeugen, sondern vielmehr zu dem Zwecke, den besten konstruieren zu lernen. Dies ist im Wesentlichen ein Stromkreis sehr hoher Selbstinduktion und geringen Widerstandes, den man wol einem typischen, in der Telegraphie mit Hertz'schen oder elektromagnetischen Wellen benutzten Stromkreise als gerade entgegengesetzt bezeichnen kann. Es ist schwer, sich von der wunderbaren Kraft dieser eigenartigen Vorrichtung einen Begriff zu machen. Da die elektromagnetischen Strahlungen auf eine unbedeutende Quantität herabgesetzt und richtige Resonanzverhältnisse aufrecht erhalten werden, wirkt der Stromkreis wie ein ungeheures Pendulum, indem er die primären Erregerimpulse unbegrenzt aufspeichert und der Erde und ihrer leitenden Atmosphäre gleich-

isomische harmonische Schwingungen aufregt, deren Intensitaeten, wie wirkliche Versuche gezeigt haben, so weit getrieben werden koennen, dass sie diejenigen, welche bei der natuerlichen Entladung statischer Elektrizitaet erreicht werden, uebertreffen.

Gleichzeitig mit diesen Bestrebungen wurden auch die Mittel der Individualisierung und Absonderung der Energie allmaehlich verbessert. Grosse Wichtigkeit wurde dieser Arbeit beigemessen, denn es fand sich, dass einfaches Abstimmen nicht hinreichte, um den strengen praktischen Erfordernissen gerecht zu werden. Die fundamentale Idee, zum Zwecke der Absonderung der uebertragenen Energie eine Anzahl absonderlicher, kooperativ vereinigter Elemente anzuwenden, fuehre ich direkt auf meine Lektuere von Spencer's klarer und anregender Auslegung des menschlichen Nervenmechanismus zurueck. Welchen Einfluss dieses Prinzip auf die Uebertragung von Intelligenz und elektrischer Energie im Allgemeinen haben wird, kann jetzt noch nicht abgeschaezt werden, denn die Kunst ist noch im Keinzustande; aber die gleichzeitige Uebermittlung von tausenden von telegraphischen oder telephonischen Botschaften durch einen einzigen Leitungskanal, sei er natuerlich oder kuenstlich, ohne gefaehrliche gegenseitige Stoerung, ist gewiss moeglich, waehrend Millionen moeglich sind. Andererseits kann durch Anwendung einer grossen Anzahl kooperativer Elemente und willkuerliche Absonderung ihrer absonderlichen Eigenschaften und ihrer Reihenfolge ~~in~~ ein beliebiger Grad der Individualisierung erreicht werden. Aus augenscheinli-

chen Gruenden wird dieses Prinzip auch fuer die Erweiterung der Uebertragungsentfernung von Wert sein.

Der Fortschritt, obgleich notwendigerweise langsam, war bestaendig und sicher, denn die Ziele, nach denen ich strebte, waren in der Richtung meiner fortwaehrenden Studien und Thaetigkeit. Es ist deshalb kein Wunder, dass ich schon vor Ende des Jahres 1899 die unternommene Aufgabe beendete und die Resultate erreichte, welche ich in meinem Artkel im Century Magazine vom Juni, 1900, in dem jedes Wort sorgfaeltig gewogen wurde, anzeigte.

Es ist schon viel getan, um mein System kommerziellem Gebrauch zur Verfuegung zu stellen, sowohl zur Uebertragung von Energie in kleinen Quantitaeten fuer spezifische Zwecke, als auch auf industriellem Maassstabe. Die von mir erzielten Resultate haben meinen Plan der Intelligenzuebermittlung; fuer welche der Name "Welttelegraphie" vorgeschlagen worden ist, leicht ausfuehrbar gemacht. Das Prinzip ihrer Wirkung, die angewandten Mittel und ihre Anwendungsmoeglichkeiten bilden, glaube ich, eine radikale und fruchtbare Abweichung von dem, was vorher getan worden ist. Ich habe keinen Zweifel, dass sie sich fuer die Aufklaerung der Massen, besonders in noch uncivilisierten Laendern und schwer zugaenglichen Regionen, sehr wirksam erweisen, und dass sie zur allgemeinen Sicherheit, Bequemlichkeit und Wohlbefinden, und der Aufrechterhaltung friedlicher Verhaeltnisse wesentlich beitragen wird. Sie bedingt die Anwendung einer Anzahl von Anlagen, welche alle instande sind,

individualisierte Signale nach den äussersten Grenzen der Erde zu senden. Jede derselben wird vorzugsweise in der Nähe eines wichtigen Civilisationspunktes gelegen sein, und die Nachrichten, welche sie durch beliebige Mittel und Wege empfängt, werden nach allen Punkten der Erde geblickt. Eine billige und einfache Vorrichtung, die man in der Tasche tragen könnte, kann dann irgendwo auf See oder Land aufgestellt werden, und wird die Neuigkeiten der Welt, oder solche spezielle Depeschen, die fuer sie bestimmt sind, verzeichnen. Auf diese Weise wird die ganze Erde so zu sagen in ein riesiges Gehirn verwandelt werden, welches imstande ist, in jedem Teile die Mitteilungen aufzunehmen. Da eine einzige Anlage von nur hundert Pferdestärken hunderte Millionen von Instrumenten betätigen kann, wird das System ein tatsächlich unbegrenztes Arbeitsvermögen haben, und muss notwendigerweise die Uebermittlung von Intelligenz ungeheuer erleichtern und billiger machen.

Die erste dieser Centralanlagen wäre schon beendet, wenn sich nicht unvorhergesehene Verzögerungen eingestellt hätten, die jedoch glücklicherweise nichts mit dem rein technischen Charakter zu tun haben. Aber dieser Zeitverlust, obgleich verdriesslich, dürfte sich schliesslich doch als ein Segen in Verkleidung erweisen. Die beste mir bekannte Konstruktion ist gewählt worden, und der Sender wird einen Wellenkomplex von einer gesanten maximalen Aktivität von zehn Millionen Pferdestärken, von welcher kein Prozent reichlich genug ist, "die Erdkugel zu unguerten", von sich geben. Der Effekt dieser ungeheuren Energieabgabe, fast zweimal so

viel als die gesamten Niagaraquelle, kann nur durch Anwendung gewisser Kunstgriffe, die ich seiner Zeit bekannt machen werde, erzielt werden.

~~Hier~~ [Einen grossen Teil der Arbeit, die ich bis jetzt getan habe, habe ich der edlen Grossmutter Herrn J. Pierpont Morgan's zu verdanken, die um so willkommener und ermutigender war, weil sie zu einer Zeit gewahrt wurde als diejenigen, die seitdem am meisten versprochen haben, die grössten Zweifler waren. Auch meinen Freund Stanford White muss ich fuer viele uneigennuetzige und wertvolle Hilfe danken. Diese Arbeit ist nun weit vorgeschritten, und wenn auch die Resultate verspätet sind, werden sie doch sicher kommen.

Die Uebertragung von Energie auf industriellem Maassstabe wird mittlerweile nicht vernachlaessigt. Die Canadian Niagara Power Company hat mir ein vorzuegliches Angebot gemacht, und eine fast eben so grosse Genugthuung als das Erringen von Erfolg der Kunst halber wird es mir verschaffen, ihre Konzession fuer sie finanziell vorteilhaft zu machen. In dieser ersten Kraftanlage, mit deren Entwurf ich seit langer Zeit beschaeftigt bin, beabsichtige ich, zehn tausend Pferdekraefte unter einer Spannung von hundert Millionen Volt, die ich jetzt mit Sicherheit erzeugen und ^{zu} haddhaben kann, zu verteilen.

Diese Energie wird ueberall auf der Erde gesammelt werden, vorzugsweise in kleinen Quantitaeten, von einem Bruchteil einer bis

Oct, 1919,

mehreren Pferdestärken. Einer ihrer Hauptanwendungen wird die Beleuchtung vereinzelter geleerter Heimstätten sein. Es ^{bedarf} ~~es~~ sehr wenig Kraft, eine Wohnung mit Vakuumröhren, die von Hochfrequenzströmen erregt werden, zu erleuchten, und in jedem Falle wird ein ein wenig ueber dem Dach erhobener Pol hinreichen. Noch ein wertvoller Gebrauch wird das Antreiben von Uhren und dergleichen Apparate sein. Diese Uhren werden ausserordentlich einfach sein, werden absolut keiner Wartung beduerfen und werden genau die richtige Zeit angeben. Die Idee der Erde amerikanische Zeit aufzupraegen ist bezaubernd und wird sehr wahrscheinlich populaer werden. Es giebt unzählbare Vorrichtungen aller Arten, die entweder jetzt im Gebrauch sind oder geliefert werden koennen, und indem ich sie auf diese Weise in Betrieb setze, ^{duerfte} ~~werde~~ ich imstande sein, mit einer Anlage von nicht mehr als zehn tausend Pferdestärken der ganzen Welt eine grosse Kommoditaet zu bieten. Die Einfuehrung dieses Systems wird Gelegenheiten gewahren fuer Erfindung und Fabrikation, wie sie sich noch nie vorher dargeboten haben.

Da ich der weitreichenden Wichtigkeit dieses ersten Versuchs und dessen Einfluss¹ auf zukuenftige Entwicklung gewaertig bin, werde ich langsam und sorgfaeltig zu Werke gehen. Erfahrung hat mich gelehrt fuer Unternehmungen, die nicht gaenzlich von meinen eigenen Faehigkeiten und Anstrengungen abhaengen, einen Termin festzusetzen. Aber ich bin voller Hoffnung, dass diese grossen Verwirklichungen nicht weit entfernt sind, und ich weiss dass, wenn dieses erste Werk vollendet ist, sie mit mathematischer Gewissheit folgen werden.

OCT, 1919,

Wenn die grosse, zufaellig enthuellte und experimentell
bestaetigte Wahrheit voellig erkannt wird, dass dieser Planet, bei
all seiner erschreckenden Unermesslichkeit, fuer elektrische Stroe-
me tatsaechlich nichts mehr ist als eine kleine Metallkugel und
dass ~~infolge~~ dieser Tatsache die Verwirklichung vieler Moeglichkei-
ten, von denen jede der Einbildungskraft spottet und von unberechen-
barer Bedeutung ist, absolut sicher macht; wenn die erste Anlage in
Betrieb gesetzt und bewiesen wird, dass eine telegraphische Bot-
schaft, fast so geheim und unstoerbar wie ein Gedanke, auf irgend
eine irdische Entfernung uebertragen werden, dass der Schall der
menschlichen Stimme, mit allen ihren Intonationen und Modulationen,
getreu und augenblicklich an irgend einer andern Stelle der Erde
wieder erzeugt werden, dass die Energie eines Wasserfalles zur
Lieferung von Licht, Waerme und Triebkraft, irgendwo - auf See, oder
Land oder hoch oben in der Luft - verwendbar gemacht werden kann,
dann wird die Menschheit sein wie ein Ameisenhaufe, den man mit
einem Stock aufgeruehrt hat: Sehet die Aufregung die da kommt!

MY INVENTIONS

AS PUBLISHED IN OCT., 1919,
ELECTRICAL EXPERIMENTER

by Nikola Tesla.

VI. The Art of Telautomatics.

How Tesla's Mind Recuperates.

No subject to which I have ever devoted myself has called for such concentration of mind and strained to so dangerous a degree the finest fibers of my brain as the system of which the Magnifying Transmitter is the foundation. I put all the intensity and vigor of youth in the development of the rotating field discoveries, but those early labors were of a different character. Although strenuous in the extreme, they did not involve that keen and exhausting discernment which had to be exercised in attacking the many puzzling problems of the wireless. Despite my rare physical endurance at that period the abused nerves finally rebelled and I suffered a complete collapse, just as the consummation of the long and difficult task was almost in sight. Without doubt I would have paid a greater penalty later, and very likely my career would have been prematurely terminated, had not providence equipped me with a safety device, which has seemed to improve with advancing years and unfailingly comes into play when my forces are at an end. So long as it operates I am safe from danger, due to overwork, which threatens other inventors and, incidentally, I need no vacations

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which are indispensable to most people. When I am all but used up I simply do as the darkies, who "naturally fall asleep while white folks worry". To venture a theory out of my sphere - the body probably accumulates little by little a definite quantity of some toxic agent and I sink into a nearly lethargic state which lasts half an hour to the minute. Upon awakening I have the sensation as though the events immediately preceding had occurred very long ago, and if I attempt to continue the interrupted train of thought I feel a veritable mental nausea. Involuntarily I then turn to other work and am surprised at the freshness of the mind and ease with which I overcome obstacles that had baffled me before. After weeks or months my passion for the temporarily abandoned invention returns and I invariably find answers to all the vexing questions with scarcely any effort.

In this connection I will tell of an extraordinary experience which may be of interest to students of psychology. I had produced a striking phenomenon with my grounded transmitter and was endeavoring to ascertain its true significance in relation to the currents propagated through the earth. It seemed a hopeless undertaking and for more than a year I worked unremittingly but in vain. This profound study so entirely absorbed me that I became forgetful of everything else, even of my undermined health. At last, as I was at the point of breaking down, nature applied the preservative inducing lethal sleep. Regaining my senses, I realized with consternation that I was

unable to visualize scenes from my life except those of infancy, the very first ones that had entered my consciousness. Curiously enough, these appeared before my vision with startling distinctness and afforded me welcome relief. Night after night, when retiring, I would think of them and more and more of my previous existence was revealed. The image of my mother was always the principal figure in the spectacle that slowly unfolded, and a consuming desire to see her again gradually took possession of me. This feeling grew so strong that I resolved to drop all work and satisfy my longing. But I found it too hard to break away from the laboratory and several months elapsed during which I had succeeded in reviving all the impressions of my past life up to the spring of 1892. In the next picture that came out of the mist of oblivion, I saw myself at the Hotel de la Paix in Paris just coming to from one of my peculiar sleeping spells, which had been caused by prolonged exertion of the brain. Imagine the pain and distress I felt when it flashed upon my mind that a dispatch was handed to me at that very moment bearing the sad news that my mother was dying; I remembered how I made the long journey home without an hour of rest and how she passed away after weeks of agony! It was especially remarkable that during all this period of partially obliterated memory I was fully alive to everything touching on the subject of my research. I could recall the smallest details and the least insignificant observations in my experiments and even recite pages of text and complex mathematical formulae.

My belief is firm in a law of compensation. The true rewards are ever in proportion to the labor and sacrifices made. This is one of the reasons why I feel certain that of all my inventions, the Magnifying Transmitter will prove most important and valuable to future generations. I am prompted to this prediction not so much by thoughts of the commercial and industrial revolution which it will surely bring about, but of the humanitarian consequences of the many achievements it makes possible. Considerations of mere utility weigh little in the balance against the higher benefits of civilization. We are confronted with portentous problems which can not be solved just by providing for our material existence, however abundantly. On the contrary, progress in this direction is fraught with hazards and perils not less menacing than those born from want and suffering. If we were to release the energy of atoms or discover some other way of developing cheap and unlimited power at any point of the globe this accomplishment, instead of being a blessing, might bring disaster to mankind in giving rise to dissension and anarchy which would ultimately result in the enthronement of the hated regime of force. The greatest good will come from technical improvements tending to unification and harmony, and my wireless transmitter is preëminently such. By its means the human voice and likeness will be reproduced everywhere and factories

driven thousands of miles from waterfalls furnishing the power; aerial machines will be propelled around the earth without a stop and the sun's energy controlled to create lakes and rivers for motive purposes and transformation of arid deserts into fertile land. Its introduction for telegraphic, telephonic and similar uses will automatically cut out the statics and all other interferences which at present impose narrow limits to the application of the wireless. This is a timely topic on which a few words might not be amiss.

Tesla Raps "Static" Men Vigorously.

During the past decade a number of people have arrogantly claimed that they had succeeded in doing away with this impediment. I have carefully examined all of the arrangements described and tested most of them long before they were publicly disclosed, but the finding was uniformly negative. A recent official statement from the U. S. Navy may, perhaps, have taught some beguible news editors how to appraise these announcements at their real worth. As a rule the attempts are based on theories so fallacious that whenever they come to my notice I can not help thinking in a lighter vein. Quite recently a new discovery was heralded, with a deafening flourish of trumpets, but it proved another case of a mountain bringing forth a mouse. This reminds me of an exciting incident which took place years ago when I was conducting my experiments with currents of high frequency. Steve Brodie had just jumped off the Brooklyn Bridge. The feat has been vulgarized since by imitators, but the

first report electrified New York. I was very impressionable then and frequently spoke of the daring printer. On a hot afternoon I felt the necessity of refreshing myself and stepped into one of the popular thirty thousand institutions of this great City where a delicious twelve per cent beverage was served which can now be had only by making a trip to the poor and devastated countries of Europe. The attendance was large and not over-distinguished and a matter was discussed which gave me an admirable opening for the careless remark: "This is what I said when I jumped off the bridge". No sooner had I uttered these words than I felt like the companion of Timotheus in the poem of Schiller. In an instant there was a pandemonium and a dozen voices cried: "It is Brodie!" I threw a quarter on the counter and bolted for the door but the crowd was at my heels with yells: "Stop, Steve!" which must have been misunderstood for many persons tried to hold me up as I ran frantically for my haven of refuge. By darting around corners I fortunately managed - through the medium of the fire-escape - to reach the laboratory, which I threw off my coat, camouflaged myself as a hard working blacksmith, and started the forge. But these precautions proved unnecessary; I had eluded my pursuers. For many years afterward, at night, when imagination turns into spectres the trifling troubles of the day, I often thought, as I tossed on the bed, what my fate would have been had that mob caught me and found out that I was not Steve Brodie!

Now the engineer, who lately gave an account before a technical body of a novel remedy against statics based on a "heretofore unknown law of nature", seems to have been as reckless as myself when he contended that these disturbances propagate up and down, while those of a transmitter proceed along the earth. It would mean that a condenser, as this globe, with its gaseous envelop, could be charged and discharged in a manner quite contrary to the fundamental teachings propounded in every elemental text-book of physics. Such a supposition would have been condemned as erroneous, even in Franklin's time, for the facts bearing on this were then well-known and the identity between atmospheric electricity and that developed by machines was fully established. Obviously, natural and artificial disturbances propagate through the earth and the air in exactly the same way, and both set up electro-motive forces in the horizontal, as well as vertical, sense. Interference can not be overcome by any such methods as were proposed. The truth is this: In the air the potential increases at the rate of about fifty volts per foot of elevation, owing to which there may be a difference of pressure amounting to twenty, or even forty thousand volts between the upper and lower ends of the antenna. The masses of the charged atmosphere are constantly in motion and give up electricity to the conductor, not continuously but rather disruptively, this producing a grinding noise in a sensitive telephonic

receiver. The higher the terminal and the greater the space encompassed by the wires, the more pronounced is the effect, but it must be understood that it is purely local and has little to do with the real trouble. In 1900, while perfecting my wireless system, one form of apparatus comprised four antennae. These were carefully calibrated to the same frequency and connected in multiple with the object of magnifying the action, in receiving from any direction. When I desired to ascertain the origin of the transmitted impulses, each diagonally situated pair was put in series with a primary coil energizing the detector circuit. In the former case the sound was loud in the telephone; in the latter it ceased, as expected, the two antennae neutralizing each other, but the true statics manifested themselves in both instances and I had to devise special preventives embodying different principles.

The Remedy For Statics.

By employing receivers connected to two points of the ground, as suggested by me long ago, this trouble caused by the charged air, which is very serious in the structures as now built, is nullified and besides, the liability of all kinds of interference is reduced to about one-half, because of the directional character of the circuit. This was perfectly self-evident, but came as a revelation to some simple-minded wireless folks whose experience was confined to forms of apparatus that could have been improved with an axe, and they have been disposing of the bear's skin before

killing him. If it were true that strays performed such antics, it would be easy to get rid of them by receiving without serials. But, as a matter of fact, a wire buried in the ground which, conforming to this view, should be absolutely immune, is more susceptible to certain extraneous impulses than one placed vertically in the air. To state it fairly, a slight progress has been made, but not by virtue of any particular method or device. It was achieved simply by discarding the enormous structures, which are bad enough for transmission but wholly unsuitable for reception, and adopting a more appropriate type of receiver. As I pointed out in a previous article, to dispose of this difficulty for good, a radical change must be made in the system, and the sooner this is done the better.

Radio Government Control Not Wanted.

It would be calamitous, indeed, if at this time when the art is in its infancy and the vast majority, not excepting even experts, have no conception of its ultimate possibilities, a measure would be rushed through the legislature making it a Government monopoly. This was proposed a few weeks ago by Secretary Daniels, and no doubt that distinguished official has made his appeal to the Senate and House of Representatives with sincere conviction. But universal evidence unmistakably shows that the best results are always obtained in healthful commercial competition. There are, however, exceptional reasons why ^{wireless} should be given the fullest freedom of

development. In the first place it offers prospects immeasurably greater and more vital to betterment of human life than any other invention or discovery in the history of man. Then again, it must be understood that this wonderful art has been, in its entirety, evolved here and can be called "American" with more right and propriety than the telephone, the incandescent lamp or the aeroplane. Enterprising press agents and stock jobbers have been so successful in spreading misinformation that even so excellent a periodical as the Scientific American accords the chief credit to a foreign country. The Germans, of course, gave us the Hertz-waves and the Russian, English, French and Italian experts were quick in using them for signalling purposes. It was an obvious application of the new agent and accomplished with the old classical and unimproved induction coil-scarcely anything more than another kind of heliography. The radius of transmission was very limited, the results attained of little value, and the Hertz oscillations, as a means for conveying intelligence, could have been advantageously replaced by sound-waves, which I advocated in 1891. Moreover, all these attempts were made three years after the basic principles of the wireless system, which is universally employed today, and its potent instrumentalities had been clearly described and developed in America. No trace of those Hertzian appliances and methods remains today. We have proceeded in the very, opposite direction and what has been done is the product of the brains and efforts of citizens of this country. The fundamental patents have expired and the opportunities are open to all. The chief argument of the Secretary is based on interference. According to his statement reported in the New York Herald of July 29th, signals from a powerful station can be intercepted in every village of the world. In view of this fact, which was demonstrated in my experiments of 1900, it would be of little

America First.

use to impose restrictions in the United States. PAs throwing light on this point, I may mention that only recently an odd looking gentleman called on me with the object of enlisting my services in the construction of world transmitters in some distant land. "We have no money," he said, "but carloads of solid gold and we will give you a liberal amount." I told him that I wanted to see first what will be done with my inventions in America and this ended the interview. But I am satisfied that some dark forces are at work, and as time goes on the maintenance of continuous communication will be rendered more difficult. The only remedy is a system immune against interruption. It has been perfected, it exists, and all that is necessary is to put it in operation.

The terrible conflict is still uppermost in the minds and perhaps the greatest importance will be attached to the Magnifying Transmitter as a machine for attack and defense, more particularly in connection with telautomatics. This invention is a logical outcome of observations begun in my boyhood and continued throughout my life. When the first results were published, the Electrical Review stated editorially that it would become one of the "most potent factors in the advance and civilization of mankind". The time is not distant when this prediction will be fulfilled. In 1898 and 1900 it was offered to the Government and might have been adopted were I

one of those who would go to Alexander's shepherd when they want something from Alexander. At that time I really thought that it would abolish war, because of its unlimited destructiveness, and elimination of the personal element of combat. But while I have not lost faith in its potentialities, my views have changed since.

The Road To Permanent Peace.

War can not be avoided until the physical cause for its recurrence is removed and this, in the last analysis, is the vast extent of the planet on which we live. Only through annihilation of distance in every respect as, the conveyance of intelligence, transport of passengers and supplies and transmission of energy will conditions be brought about some day, insuring permanency of friendly relations. What we now want most is closer contact and better understanding between individuals and communities all over the earth, and the elimination of that fanatic devotion to exalted ideals of national egoism and pride which is always prone to plunge the world into primeval barbarism and strife. No League or parliamentary act of any kind will ever prevent such a calamity. These are only new devices for putting the weak at the mercy of the strong. I have expressed myself in this regard fourteen years ago when a combination of few leading governments - a sort of Holy Alliance - was advocated by the late Andrew Carnegie, who may be fairly considered as

the father of this idea, having given to it more publicity and
than anybody else
impetus prior to the efforts of the President. While it can
not be denied that such a pact might be of material advantage
to some less fortunate peoples, it can not attain the chief
object sought. Peace can only come as a natural consequence
of universal enlightenment and merging of races, and we are
still far from this blissful realization. As I view the
world of today, in the light of the gigantic struggle we have
witnessed, I am filled with conviction that the interests of
humanity would be best served if the United States remained
true to its traditions and kept out of "entangling alliances".
Situating as it is, geographically, remote from the theaters
of impending conflicts, without incentive to territorial
aggrandizement, with inexhaustible resources, and immense
population thoroughly imbued with the spirit of liberty and
right, this country is placed in a unique and privileged
position. It is thus able to exert, independently, its col-
ossal strength and moral force to the benefit of all, more
judiciously and effectively, than as member of a league.

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The Mechanistic Theory of Life.

In one of these biographical sketches, published in the Electrical Experimenter, I have dwelt on the circumstances of my early life and told of an affliction which compelled me to unremitting exercise of imagination and self-observation. This mental activity, at first involuntary under the pressure of illness and suffering, gradually became second nature and led me finally to recognize that I was but an automaton devoid of free will in thought and action and merely responsive to the forces of the environment. Our bodies are of such complexity of structure, the motions we perform are so numerous and involved, and the external impressions on our sense organs to such a degree delicate and elusive that it is hard for the average person to grasp this fact. And yet nothing is more convincing to the trained investigator than the mechanistic theory of life which had been, in a measure, understood and propounded by Descartes three hundred years ago. But in his time many important functions of our organism were unknown and, especially with respect to the nature of light and the construction and operation of the eye, philosophers were in the dark. In recent years the progress of scientific research in these fields has been such as to leave no room for a doubt in regard to this view on which many works have been published. One of its ablest and most eloquent exponents is, perhaps, Felix Le Dantec, formerly assistant of Pasteur. Prof. Jacques Loeb has performed remarkable experiments in heliotropism, clearly establishing the controlling power of light in

lower forms of organisms and his latest book "Forced Movements" is revelatory. But while men of science accept this theory simply as any other that is recognized, to me it is a truth which I hourly demonstrate by every act and thought of mine. The consciousness of the external impression prompting me to any kind of exertion, physical or mental, is ever present in my mind.

Only on very rare occasions, when I was in a state of exceptional concentration, have I found difficulty in locating the original impulses. ^{far} The by far greater ^{number} of human beings are never aware of what is passing around and within them, and millions fall victims of ^{disease} and die prematurely just on this account. The commonest, everyday occurrences appear to them mysterious and inexplicable. One may feel a sudden wave of sadness and rake his brain for an explanation when he might have noticed that it was caused by a cloud cutting off the rays of the sun. He may see the image of a friend dear to him under conditions which he construes as very peculiar, when only shortly before he has passed him in the street or seen his photograph somewhere. When he loses a collar button he fusses and swears for an hour, being unable to visualize his previous actions and locate the object directly. Deficient observation is merely a form of ignorance and responsible for the many morbid notions and foolish ideas prevailing. There is not more than one out of every ten persons who does not believe in telepathy and other psychic manifestations, spiritualism and communion with the dead and who would refuse to listen to

willing or unwilling deceiver. Just to illustrate how deeply rooted this tendency has become even among the clear-headed Psychic Phenomena in the Manufacture of Flyers. American population, I may mention a comical incident. Shortly before the war, when the exhibition of my turbines in this City elicited widespread comment in the technical papers, I anticipated that there would be a ^{scramble} ~~surx~~ among manufacturers to get hold of the invention and I had particular designs on that man from Detroit who has an uncanny faculty for accumulating millions. So ^{confident} ~~surx~~ was I that he would turn up some day, ~~surx~~ that I declared this as certain to my secretary and assistants. Sure enough, one fine morning a body of engineers, ^{from} ~~representing~~ the Ford Motor Company presented themselves with the request of discussing with me an important project. "Didn't I tell you?" I remarked triumphantly to my employees, and one of them said, "You are wonderfully Mr. Tesla, everything comes out exactly as you predict." As soon as these ^{hard-headed} ~~distinguished~~ men were seated I, of course, immediately began to extol the wonderful features of my turbine when the spokesman interrupted me and said, "We know all about this but we are on a special errand. We ^{have} formed a psychological society for the investigation of psychic phenomena and we want you to join us in this undertaking." I suppose these engineers never knew how near they came to being fired out of my office.

COMPUTING SPIRITISM.

Ever since I was told by some of the greatest men of the time, leaders in science whose names are immortal, that I am possessed of an unusual mind, I bent all my thinking faculties on the solution of great problems regardless of sacrifice.

For many years I endeavored to solve the enigma of death and watched eagerly for every kind of spiritual indication. But only once in the course of my existence have I had an experience which, momentarily, impressed me as supernatural. It was at the time of my mother's death. I had become completely exhausted by pain and long vigilance and one night was carried to a building about two blocks from our home. As I lay helpless there, I thought that if my mother died while I was away from her bedside she would surely give me a sign. Two or three months before I was in London in company with my late friend, Sir William Crookes, when spiritualism was discussed and I was under the full sway of these thoughts. I might not have paid attention to other men but was susceptible to his arguments as it was his epochal work on radiant matter, which I had read as a student, that made me embrace the electrical career. I reflected that the conditions for a look into the beyond were most favorable, for my mother was a woman of genius and particularly excelling in the powers of intuition. During the whole night every fiber in my brain was strained in expectancy, but nothing happened ^{until} ~~xxx~~ early in the morning ^{when} I fell in a sleep or perhaps a swoon, and saw a cloud carrying angelic figures of marvelous beauty, one of whom gazed upon me lovingly and gradually assumed the features of my mother. The appearance slowly floated across the room and vanished and I was awakened by an indescribably sweet song of many voices. In that instant a certitude, which no words can express, came upon me that my mother had ^{just} died. And that was true. I have ~~xxxxxxxxxxxx~~

was
unable to understand the tremendous weight of the painful knowledge I received in advance and wrote a letter to Sir William Crookes while still under the domination of these impressions and in poor bodily health. When I recovered I sought for a long time the external cause of this strange manifestation and, to my great relief, I succeeded after many months of fruitless effort. I had seen the painting of a celebrated artist, representing allegorically one of the seasons in the form of a cloud with a group of angels which seemed to actually float in the air, and this had struck me forcefully. It was exactly the same that appeared in my dream with the exception of my mother's likeness. The music came from the choir in the church^{nearby} at the early mass of Easter morning, explaining everything satisfactorily in conformity with scientific facts.

This occurred long ago and I have never had the faintest reason since to change my views on psychical and spiritual phenomena for which there is absolutely no foundation. The belief in these is the natural outgrowth of intellectual development. Religious dogmas are no longer accepted in their orthodox meaning but every individual clings to some faith in a Supreme power of some kind. We^{all} must have^{an} ideal to govern our conduct and insure contentment but it is immaterial whether it be one of creed, art, science or anything else, so long as it fulfills the function of a dematerializing force. It is essential to the peaceful existence of humanity as a whole that one common conception should prevail.

Tesla's Antecedents Discovery.

While I have failed to obtain any evidence in support

of the contentions of psychologists and spiritualists, I have proved to my complete satisfaction the automatism of life, not only through continuous observations of individual actions, but even more conclusively, through certain generalizations. These amount to a discovery which I consider of the greatest moment to human society and on which I shall briefly dwell. I got the first inkling of this astounding truth when I was still a very young man, but for many years I interpreted what I noted simply as coincidences. Namely, whenever either myself or a person to whom I was attached, or a cause to which I was devoted, was hurt by others in a particular way, which might be best popularly characterized as the most unfair imaginable, I experienced a singular and undefinable pain which, for want of a better term, I have qualified as "cosmic", and shortly thereafter, and invariably, those who had inflicted it came to grief. After many such cases I confided this to ^{a number of friends,} ~~others~~ who had the opportunity to convince themselves of the truth of the theory which I ^{have} ~~am~~ gradually formulated and which may be stated in the following few words.

Our bodies are of similar construction and exposed to the same external influences. This results in likeness of response and concordance of the general activities on which all our social and other rules and laws are based. We are automata entirely controlled by the forces of the medium, being tossed about like corks on the surface of the water, but mistaking the resultant of the impulses from the outside for free will. The movements and other actions we perform are always life-preservative

and though seemingly quite independent from one another, we are connected by invisible links. So long as the organism is in perfect order it responds accurately to the agents that prompt it, but the moment that there is some derangement in any individual, his self-preservative power is impaired. Everybody understands, of course, that if one becomes deaf, has his eyesight weakened, or his limbs injured, the chances for his continued existence are lessened. But this is also true, and perhaps moreso, of certain defects in the brain which deprive the automaton, more or less, of that vital quality and cause it to rush into destruction. A very sensitive and observant being, with his highly developed mechanism all intact, and acting with precision in obedience to the changing conditions of the environment, is endowed with a transcending mechanical sense, enabling him to evade perils too subtle to be directly perceived. When he comes in contact with others whose controlling organs are radically faulty, that sense asserts itself and he feels the 'cosmic' pain. The truth of this has been borne out in hundreds of instances and I am inviting other students of nature to devote attention to this subject, believing that through combined and systematic effort results of incalculable value to the world will be attained.

Dr. Tesla's First Telautomaton.

The idea of constructing an automaton, to bear out my theory, presented itself to me early but I did not begin active work until 1893, when I started my wireless investigations. During the succeeding two or three years a number of automatic mechanisms,

to be from a
A actuated, at distance, were constructed by me and exhibited to
visitors in my laboratory. In 1896, however, I designed a complete
machine capable of a multitude of operations, but the consummation
of my labors was delayed until late in 1897. This machine was
illustrated and described in my article in the Century Magazine
of June, 1900, and other periodicals of that time and, when first
shown in the beginning of 1898, it created a sensation such as
no other invention of mine has ever produced. In November, 1898,
a basic patent on the novel art was granted to me, but only after
the Examiner-in-Chief had come to New York and witnessed the per-
formance, for what I claimed seemed unbelievable. I remember that
when later I called on an official in Washington, with a view of
offering the invention to the Government, he burst out in laughter
upon my telling him what I had accomplished. Nobody thought then
that there was the faintest prospect of perfecting such a device.
It is unfortunate that in this patent, following the advice of my
attorneys, I indicated the control as being effected through the
medium of a single circuit and a well-known form of detector, for
the reason that I had not yet secured protection on my methods and
apparatus for individualization. As a matter of fact, my boats
were controlled through the joint action of several circuits and
interference of every kind was excluded. Most generally I employed
receiving circuits in the form of loops, including condensers,
because the discharges of my high tension transmitter ionized the
air in the hall so that even a very small aerial would draw elec-
tricity from the surrounding atmosphere for hours. Just to give
an idea, I found, for instance, that a bulb 12" in diameter, highly

exhausted, and with one single terminal to which a short wire was attached, would deliver well on to one thousand successive flashes before all charge of the air in the laboratory was neutralized. The loop form of receiver was not sensitive to such a disturbance and it is curious to note that it is becoming popular at this late date. In reality it collects much less energy than the aeriads or a long grounded wire, but it so happens that it does away with a number of defects inherent to the present wireless devices. In demonstrating my invention before audiences, the visitors were requested to ask any questions, however involved, and the automaton would answer them by signs. This was considered magic at that time but was extremely simple, for it was myself who gave the replies by means of the device.

At the same period another larger telautomatic boat was constructed, a photograph of which is shown in this number of the Electrical Experimenter. It was controlled by loops having several turns placed in the hull, which was made entirely water-tight and capable of submergence. The apparatus was similar to that used in the first with the exception of certain special features I introduced as, for example, incandescent lamps which afforded a visible evidence of the proper functioning of the machine and served for other purposes.

TELAUTOMATICS of the FUTURE.

These automata, controlled within the range of vision of the operator, were, however, the first and rather crude steps in the evolution of the Art of Telautomatics as I had conceived it. The next logical improvement was its application to automatic mechanisms beyond the limits of vision and at great distance from the

center of control, and I have ever since advocated their employment as instruments of warfare in preference to guns. The importance of this now seems to be recognized, if I am to judge from casual announcements through the press of achievements which are said to be extraordinary but contain no merit of novelty whatever. In an imperfect manner it is practicable, with the existing wireless plants, to launch an aeroplane, have it follow a certain approximate course, and perform some operation at a distance of many hundreds of miles. A machine of this kind can also be mechanically controlled in several ways and I have no doubt that it may prove of some usefulness in war. But there are, to my best knowledge, no instrumentalities in existence today with which such an object could be accomplished in a precise manner. I have devoted years of study to this matter and have evolved means, making such and greater wonders easily realizable. As stated on a previous occasion, when I was a student at college I conceived a flying machine quite unlike the present ones. The underlying principle was sound but could not be carried into practice for want of a prime-mover of sufficiently great activity. In recent years I have successfully solved this problem and am now planning aerial machines devoid of sustaining planes, ailerons, propellers and other external attachments, which will be capable of immense speeds and are very likely to furnish powerful arguments for peace in the near future. Such a machine, sustained and propelled entirely by reaction, is shown on one of the pages and is supposed to be controlled either

mechanically or by wireless energy. By installing proper plants it will be practicable to project a missile of this kind into the air and drop it almost on the very spot designated which may be thousands of miles away. But we are not going to stop at this. Telsautomata will be ultimately produced, capable of acting as if possessed of their own intelligence and their advent will create a revolution. As early as 1898 I proposed to representatives of a large manufacturing concern the construction and public exhibition of an automobile carriage which, left to itself, would perform a great variety of operations involving something akin to judgment. But my proposal was deemed chimerical at that time and nothing came from it.

At present many of the ablest minds are trying to devise expedients for preventing a repetition of the awful conflict which is only theoretically ended and the duration and main issues of which I have ^{correctly} predicted in an article printed in the Sun of December 20, 1914. The proposed League is not a remedy but, on the contrary, in the opinion of a number of competent men, may bring about results just the opposite. It is particularly regrettable that a punitive policy was adopted in framing the terms of peace, ^{because} ~~xxx~~ a few years hence it will be possible for nations to fight without armies, ships or guns, by weapons far more terrible, to the destructive action and range of which there is virtually no limit. Any city, at a distance whatsoever, from the enemy, can be destroyed by him and no power on earth can stop him from doing so. If we want to avert an

impending calamity and a state of things which may transform this globe into an inferno, we should push the development of flying machines and wireless transmission of energy without an instant's delay and with all the power and resources of the nation.

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of the

TESLA MACHINE COMPANY.

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ARTICLE I.

MEETING OF STOCKHOLDERS.

Sec. 1: The annual meeting of the stockholders of this Company shall be held at the office of the Corporation on the third Thursday in January of each and every year at 4 P.M. for the election of directors and such other business as may properly come before the meeting. Notice of the time, place and object of such meeting shall be given by publication thereof at least once in each week for two successive weeks immediately preceeding such meeting in the manner required by the Stock Corporation Law and by mailing at least six days previous to such meeting, postage prepaid, a copy of such notice, addressed to each stockholder at his P.O. address as same shall appear on the books of the Company. No business other than that stated in such notice shall be transacted at such meeting without the unanimous consent of all stockholders present thereat in person or by proxy.

Sec. 2: Special meetings of the stockholders other than those regulated by statute may be called at any time by a major-

BY-LAWS
of the
TESLA MACHINE COMPANY.

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ity of the directors. It shall also be the duty of the President to call such meeting when requested so to do by one director other than himself, and whenever requested in writing so to do by stockholders owning one-third of the capital stock. A notice of every special meeting, stating the time, place and object thereof, shall be given by mailing, postage prepaid, at least six days before such meeting, a copy of such notice addressed to each stockholder at his post office address as the same appears on the books of the Company.

Sec. 3: At all meetings of stockholders, there shall be present either in person or by proxy stockholders owning at least three-fifths of the capital stock of the Corporation in order to constitute a quorum except at special elections of directors pursuant to the General Corporation Law.

Sec. 4: At all annual meetings of stockholders the right of any stockholder to vote shall be governed and determined as prescribed in the General Corporation Law.

Sec. 5: If for any reason the annual meeting of the stockholders shall not be held as hereinbefore provided, such annual meeting shall be called and conducted as prescribed in the General Corporation Law.

Sec. 6: At all meetings of the stockholders only such persons shall be entitled to vote in person and by proxy who appear as stockholders on the transfer books of the Company for ten days immediately preceeding such meeting.

Sec. 7: At the annual meeting of stockholders the follow-

ing shall be the order of business, viz:

1. Calling the roll.
2. Proof of proper notice of meeting.
3. Report of President.
4. Report of Secretary.
5. Report of Treasurer.
6. Report of Committees.
7. Election of Directors and inspectors of election.
8. Miscellaneous business.

Sec. 8: At all meetings of stockholders all questions, except the question of an amendment to the By-Laws and the election of Directors and inspectors of election, and all such other questions, the manner of deciding which is specially regulated by statute, shall be determined by a majority vote of the stockholders present in person or by proxy; provided, however, that any qualified voter may demand a stock vote and in that case, such stock vote shall be taken immediately, and each stockholder present in person or by proxy shall be entitled to one vote for each share of stock owned by him. All voting shall be 'viva voce', except that a stock vote shall be by ballot, each of which shall state the name of the stockholder voting and the number of shares owned by him, and in addition, if such ballot be cast by a proxy, it shall also state the name of such proxy.

Sec. 9: At special meetings of stockholders the provisions of the General Corporation Law shall apply to the casting of all votes.

ARTICLE II.

DIRECTORS.

Sec. 1: The Directors of this Corporation shall be elected by ballot for the term of one year at the annual meeting of the stockholders, except as hereinafter otherwise provided for

filling vacancies. The directors shall be chosen by a plurality of the votes of the stockholders voting either in person or by proxy.

Sec. 2: Vacancies in the Board of Directors occurring during the year, shall be filled for the unexpired term by a majority vote of the remaining directors at any special meeting called for that purpose or at any regular meeting of the Board.

Sec. 3: In case the entire Board of directors shall die or resign, any stockholder may call a meeting in the same manner that the president may call such meeting, and Directors of the unexpired term may be elected at such special meeting in the manner provided for their election at annual meetings.

Sec. 4: The Board of Directors may adopt such rules for the regulation of their meetings and management of the affairs of the Corporation as they may deem proper, not inconsistent with the Laws of the State of New York or their by-laws.

Sec. 5: The Board of Directors shall meet at such regular times as they may fix and whenever called together by the President upon due notice given to each Director. On the written request of any Director, the Secretary shall call a special meeting of the Board.

Sec. 6: All Committees shall be appointed by the Board of Directors.

ARTICLE III.

OFFICERS.

Sec. 1: The Board of Directors immediately after the annual meeting shall choose one of their number by a majority vote

to be President and in the same manner they shall also elect a Vice President, a Treasurer, and a Secretary, and may also appoint such other officers as they may deem necessary. The elected Officers shall serve for one year or until the next annual election. The appointed Officers shall serve during the pleasure of the Board. The Board of Directors shall fix the salaries, if any, that shall be paid to the several Officers of the Company.

Sec. 2: The President shall preside at all meetings of the Board of Directors and shall act as temporary chairman at and call to order all meetings of the stockholders. He shall sign certificates of stock, sign and execute all contracts in the name of the Company when authorized so to do by the Board of Directors, appoint and discharge agents and employees subject to the approval of the Board of Directors, and he shall have the general management of the affairs of the Corporation and perform all the duties incidental to his office. At the annual meeting he shall present a written report to the stockholders, setting forth in full the condition of the Company. He shall countersign all notes or other evidences of indebtedness authorized by the Board of Directors.

Sec. 3: The Vice President shall in the absence or incapacity of the President perform the duties of that office.

Sec. 4: The Treasurer shall have the care and custody of all the funds and securities of the Corporation and deposit the same in the name of the Corporation in such banks as the Directors may elect. He shall sign certificates of stock and all checks, drafts, notes, and orders for the payment of money,

and he shall pay out the funds of the Company as authorized by the President or Board of Directors. He shall keep and have charge of the books of the Company, and at all reasonable times exhibit his books and accounts to any director or stockholder of the Company upon application at the office of the Company during business hours. He shall affix the seal of the Company to all certificates of stock and all other instruments requiring same when so directed by the Board of Directors.

Sec. 5: The Secretary shall keep the minutes of the Board of Directors and also the minutes of the meeting of the stockholders; he shall attend to the giving and serving of all notices of the Company; he shall have charge of such books and papers as the Board may direct; he shall attend to such correspondence as may be assigned to him; and perform all the duties incidental to his office.

ARTICLE IV.

CAPITAL STOCK:

Sec. 1: Subscriptions to the capital stock must be paid to the Treasurer at such time or times and in such installments as the Board of Directors may by resolution require. Any failure to pay an installment when required to be paid by the Board of Directors shall work a forfeiture of such shares of stock in arrears, pursuant to the Stock Corporation Law.

Sec. 2: Certificates of stock shall be numbered and registered in the order in which they are issued and shall be signed by the President or Vice President and by the Treasurer or Secretary, and the seal of the Corporation shall be affixed

thereto. All certificates shall be bound in a book and shall be issued in consecutive order therefrom and in the margin thereof shall be entered the name of the person owning the shares therein represented, the number of shares and the date thereof. All certificates exchanged or returned to the Corporation shall be marked cancelled with the date of cancellation by the Treasurer and shall be immediately posted in the certificate book opposite the memorandum of its issue.

Sec. 3: Transfers of stock shall only be made on the books of the Company by the holder in person or by power of attorney duly executed and acknowledged and filed with the Treasurer of the Corporation and on surrender of the certificate or certificates of such shares.

Sec. 4: Whenever the capital stock of the Company is increased, each bona fide owner of its stock shall be entitled to purchase, at the par value thereof, an amount of stock in proportion to the number of shares of stock he owns in the corporation at the time of such increase.

ARTICLE V.

DIVIDENDS.

Sec. 1: Dividends shall be declared and paid out of the surplus profits of the Corporation as often and at such times as the Board of Directors may determine.

ARTICLE VI.

INSPECTORS.

Sec. 1: Two inspectors of election shall be elected at each annual meeting of the stockholders to serve for one year,

and if any inspector shall refuse to serve or shall not be present, the meeting may appoint an inspector in his place.

ARTICLE VII.

SEAL.

Sec. 1: The Seal of the Corporation shall be in the form of a circle and shall bear the name of the Corporation and the year of its incorporation.

ARTICLE VIII.

AMENDMENTS.

Sec. 1: These by-laws may be amended at any stockholders meeting by a vote of the stockholders owning a majority of the stock, represented either in person or by proxy, provided the proposed amendment is inserted in the notice of such meeting; they may also be amended at any meeting of the Board of Directors by a three-fifths vote of the Directors.

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TESLA'S NEW SYSTEM OF FLUID PROPULSION

In subduing the forces of Nature to his service man must invariably avail himself of some process in which a fluid acts as carrier of energy, this being an essential step in any industrial undertaking dependent on mechanical power. Evidently then, a discovery or radical departure in that domain must be of extreme importance and far-reaching influence on the existing conditions and phases of modern life.

Fluid propulsion is now effected by means of pistons, vanes or blades, which entail complexity of construction and impose many limi-

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tations on the propelling as well as propelled mechanism and its performance. Tesla has dispensed with these devices and produced machines of extraordinary simplicity which, moreover, are in many other respects superior to the old types universally employed. A few words will be sufficient to convey a clear idea of his invention.

Every fluid, as water or air, possesses two salient properties: adhesion and viscosity. Owing to the first it is attracted and clings to a metallic surface; by virtue of the second it resists the separation of its own particles. As an inevitable consequence a cor-

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tain amount of fluid is dragged along by a body propelled through it; conversely, if a body be placed in a fluid in motion it is impelled in the direction of movement. The practical forms of Tesla's apparatus consist of flat, circular disks, with central openings, mounted on a shaft and enclosed in a casing provided with ports at the peripheral and central portions. When deriving energy from any kind of fluid it is admitted at the periphery and escapes at the centre; when, on the contrary, the fluid is to be energized, it enters in the centre and is expelled at the periphery. In either case it traverses the in-

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teristics between the disks in a spiral path,
power being derived from, or imparted to it,
by purely molecular action. In this novel man-
ner the heat energy of steam or explosive mix-
tures can be transformed with high economy in-
to mechanical effort; motion transmitted from
one shaft to another without solid connection;
vessels may be propelled with great speed; wat-
er raised or air compressed; an almost perfect
vacuum can be attained, substances frozen and
gases liquefied.

While this improvement has the
breadth and applicability of a fundamental
mechanical concept, the widest field for its

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commercial exploitation is, obviously, the thermodynamic conversion of energy.

The commercial value of a prime-mover is determined by its efficiency, specific performance relative to weight and space occupied, cheapness of manufacture, safety and reliability of operation, adaptability to construction in large units, capability of running at high peripheral velocity, reversibility, and a number of other features of lesser importance. In the majority of these a machine, operating on the new principle, excels. But there is one quality which is most desirable in a thermo-dynamic transformer from the

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economic point of view, and that is great resistance to deterioration and impairment of efficiency by heat.

The employment of high temperature is of such vital bearing on the efficiency of prime-movers that it is of paramount importance to extend the thermal range as far as practicable. In the present state of the art radical progress towards more economical transformation of the energy of fuel can only be achieved in that direction. Such being the case, the capability of the machine to withstand deteriorating effects of great heat is the controlling factor in determining its commercial value. In that most desired quality the

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Tesla turbine surpasses all the older types of heat motors. The Diesel and other internal combustion engines are fatally limited in this respect by their complete dependence on closely fitting sliding joints and unfailing supply of clean lubricant; while in the present forms of turbines buckets, blades and inherent mechanical deficiencies impose similar restrictions. These parts are too delicate and perishable to serve as elements of a gas turbine and this has been the main obstacle in the way of its successful realization. The rotor of the Tesla turbine presents a relatively enormous

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motive area and the wear is quite insignificant as the fluid, instead of striking against the propelling organs in the usual destructive manner, flows parallel with the same, imparting its momentum by adhesion and viscosity instead of impact. Moreover, it has been shown that the efficiency of this form of rotor is not impaired to any appreciable degree by a roughening of the disks and that it operates satisfactorily even if the working medium is corrosive to an extent.

The universal adoption of steam as motive power under certain standard conditions, settled upon in the course of time, gradually forced upon the minds of engineers the Rankine

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Cycle Efficiency as criterion of performance and long continued endeavors to improve the same have finally resulted in complex multistage constructions entirely unsuitable for high temperatures. The Tesla turbine, by virtue of its exceptional heat-resisting and other unique properties, makes possible the attainment of great fuel economy with but a single stage, incidentally offering the additional advantages of an extremely simple, small, compact, and reliable mechanism. But perhaps the chief commercial value of this new prime-mover will be found in the fact that it can be operated with the cheapest grade of crude oil, colloidal fuel, or powdered coal, containing con-

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siderable quantities of grit, sulphur and other impurities, thus enabling vast sums of money to be saved annually in the production of power from fuel.

The Tesla turbine also lends itself to use in conjunction with other types, especially with the Parsons with which it forms an ideal combination. Although its practical introduction has been delayed by the force of circumstances, a number of years have been spent in exhaustive investigations and experiments on the basis of which the performance in any given case can be closely calculated. The first public tests were made before the

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outbreak of the war at the Waterside Station of the New York Edison Company where several machines, ranging from 100 to 5000 h.p., were installed and operated with satisfactory results. That the invention was appreciated by the technical profession may be seen from the excerpts of statements by experts and periodicals printed on the annexed page.

The salient advantages of the Tesla turbine may be summed up as follows:

EFFICIENCY: The most economical of the present prime-movers is the Diesel engine. But, quite apart of many practical and com-

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mercial drawbacks, inseparable from this type, it is entirely dependent on comparatively expensive oil, so that the Tesla Gas Turbine, working with much cheaper fuel, would have the better in competition even if its efficiency as a thermodynamic transformer were appreciably lower, all the more so in view of its greater mechanical perfection.

Referring to turbines, all of which are surpassed by the Parsons in economy as well as extent of use, definite limits have already been reached and the only possibilities of saving fuel exist in the employment of steam at very high superheat

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and utilization of gas or oil as motive fuel.

But none of the primemovers mentioned is adapted for such operation and although every effort has been made in this direction, no signal success has been achieved. The superheat is at most 250° F, this being considered the maximum permissible. All attempts to considerably extend the thermal range have failed chiefly because of the inability of bucket structures to withstand the action of intense heat. The Tesla Turbine can operate quite satisfactorily with the motive agent at very high temperature and, owing to this quality,

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lends itself exceedingly well to these purposes.

SPECIFIC PERFORMANCE: In this particular it is superior to all other forms. Each disk is virtually the equivalent of a whole bucket wheel, and as many of them take up but a small width the output of the machine, considering its weight and size, is surprisingly great. This, while not being a measure of efficiency, is nevertheless a feature of considerable importance in many instances.

CHEAPNESS OF MANUFACTURE: The new turbine can be produced without a single machined part except the shaft, all the disks being punched

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and the casings pressed. By this method, with proper machinery installed on a large scale, the cost of production may be reduced to a figure never deemed possible in the construction of an engine. What is more, this can be done without material sacrifice of efficiency as small clearances are not essentially required.

SAFETY AND RELIABILITY OF OPERATION: There is an ever present danger in the running of high speed machines. A bucket turbine may at any moment run away and wreck the plant. Such accidents have happened again and again and this

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peril has often proved a deterrent to investment.

A remarkable quality of this turbine is its complete safety. As regards the wear and tear of the propelling organs it is significant and, in any event, of no consequence on the performance.

ADAPTABILITY TO CONSTRUCTION IN LARGE UNITS: In

all the present machines there is a distinct limit to capacity, for although large units can be manufactured, they are very costly and difficult to manage. The new turbine is so simple and the output so large that the limits in this direction can be greatly extended.

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RESISTANCE TO DETRIMENTATION BY HEAT AND OTHER

AGENTS: In this feature again it has an overwhelming advantage over the old types in which the maintenance of smooth surfaces and sharp edges is indispensable to efficient working. In the Tesla Turbine, for the reasons already stated, the destructive actions of heat and corrosive agents are much less pronounced and of relatively negligible effect. This fact has a most important bearing on the saving of fuel.

CAPABILITY OF RUNNING AT HIGH PERIPHERAL SPEED:

In this respect also it is superior to others. The rotating structure carries no load and is

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excellently adapted to withstand tensile stresses. Judging from the most recent turbine practice this quality should be of special value.

REVERSIBILITY: The present turbines are greatly handicapped by their incapability of reversal which is a very serious defect in certain applications, as the propulsion of vessels, necessitating the employment of auxiliary turbines which detracts from the propulsive power and adds materially to the cost of production and maintenance of the equipment. The Tesla Turbine has the unique

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property of being reversible; not only this but it operates with the same efficiency in either direction. For marine purposes it therefore constitutes an ideal motor whether used alone or in conjunction with older types.

Besides the above it possesses other desirable features, constructive and operative, which will add to its value and adaptability to many industrial and commercial uses as, railroading, marine navigation, aerial propulsion, generation of electricity, refrigeration, operation of trucks and automobiles, hydraulic gearing, agriculture, irrigation, mining and similar purposes.

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EXPRESSIONS OF OPINION ON THE TESLA TURBINE

- C. B. Richards, Professor Emeritus of Mechanics, Yale University: "I am amazed at the development of power given by the turbine and stunned by the exhibit."
- F. Sargent, Chief Engineer and Turbine Expert: "I am impressed with the newness and novelty of the underlying principle of this invention. It is such as will claim the attention and admiration of anyone of a scientific turn of mind in a mechanical direction."
- Reynold Janney, Chief Engineer, Universal Transmission Co: "It is a great invention."
- Brigadier Allen of the War Department: "Something new in the world. Officers are greatly impressed with it."
- Miller Ross Hutchinson, Chief Engineer: "It is the greatest invention of the age."
- Arnold Tringy, Chief Engineer, Gelfeunungs-Gesellschaft, Germany: "The ideal of the turbine engine."
- B. R. T. Collins (Power Plant Economist): "It is a wonderful turbine."
- The Motor World: "The new principle unquestionably is a great contribution to science and engineering, great in its simplicity and breadth of application."
- Scientific American: "Considered from the mechanical standpoint, the turbine is astonishingly simple and economical in construction, should prove to possess such a durability and freedom from wear and breakdown as to place it, in these respects, far in advance of any type of steam or gas motor of the present day."
- Engineering Magazine: "An entirely new form of prime mover with interesting possibilities."
- Technical World Magazine: "The Tesla Turbine is the apotheosis of simplicity. It is so violently opposed to all precedent that it seems unbelievable."

From Numerous Articles and Comments:

"The turbine is different in principle to any heretofore in use and one which will take less room and less coal than the best engine now running".....
"Turbine of revolutionary design".... "Improvement in dynamics which promises revolutionary results"..
"Results seem revolutionary to the point of staggering the imagination".... "This motor will revolutionize the turbine industry".... "Wonderful motor. Extraordinary mechanical principle".... etc. etc.

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CORPORATION BUREAU

STATE OF NEW YORK

Office of the Secretary of State

Albany, August 9, 1916

Geo. Schereff, Esq.,
Secy., Nikola Tesla Co.,
8 West 40th St., N. Y. City.

Dear Sir:

Enclosed herewith please find check for
\$ 1.25, the amount of overpayment of fees in
relation to the certificate of incorporation
of Tesla Company, Inc.

Yours respectfully,

A handwritten signature in cursive script, appearing to read "Francis B. Hendon".

Secretary of State

Drechsler und Eggenmacher.

Nordseebad Altenbruch, 9. Sept. 1902

Jung geliebte Kinder

[illegible]

J. Georg Scherff,
Turner (lathe) and Harrowmaker

North Sea Spa (Resort)
Ulenbruch
17 Sept 1902

Dearly loved children,

We received your dear letter, but it was all torn open on two sides and reglued here at the post office. It had arrived here with the address damaged. No doubt the mail carriers assumed there was a thousand mark bill in it because it was so thick. We read your letter as well as the newspaper clipping with interest and were amazed at your great enterprise. May it only come about that Mr. Tesla be successful in achieving his acceptance (joining). Then it certainly will not be to your disadvantage. We are happy, dear children, that you feel content there in spite of your isolation, and that you are all healthy. We'd like to see all of you some time, but no doubt that will just remain a wish.

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April 17, 1979

Mr. Ieland Anderson
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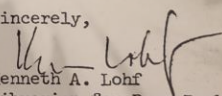
Dear Mr. Anderson:

In reply to your letter of 11 April, we have corrected our catalog cards for the Kiebitz item and checked the photocopies of your other enclosures against our collection. We have found that we don't have enclosures 2 and 4.

We do have enclosures 3 and 5 with one exception: the motor diagram supposed to have been attached to the 29 March 1918 letter to the Wisconsin Electric Company is not present. We have no idea where the lacking items you inquired about are and have no record as to ever receiving them.

All best wishes for the success of your work.

Sincerely,


Kenneth A. Lohf
Librarian for Rare Books
and Manuscripts

6/13/75

Not cataloged in
Columbia University
Special Collection

- 1) H. Y. SECRETARY OF STATE AUG. 9, 1916
- 2) J. GEORGE SCHERFF 17 SEPT. 1902

April 11, 1979

Mr. Kenneth A. Lohf,
Librarian for Rare Books and Mss.
801 Butler Library
Columbia University in the City of New York
New York, NY 10027

Dear Kenneth:

Nikola Tesla Collection (Scherff Group)

With this letter I hope to provide some information to you and receive information from you that will, taken together, clear up some possible identification problems in the subject collection. As you are probably aware, I am serving as an adviser for a major biographical work on Tesla which is now in progress. It is desirable to cite the source for information that is used or quoted, and hopefully some uncertainties with regard to a few items in the Tesla-Scherff papers can be cleared up.

The following comments and questions are based on the contents of your catalog as of June 1976:

Enclosure 1 relates to the following catalog entry:

Tesla, Nikola
Kiebitz, Franz
For Accompaniment
Berlin-Steiglitz, 4 Mar. 1932
t.ms., 4 p. (Forward (?) to S. Boksan's
book on Nikola Tesla; p. 4 entitled:
Preface). (*Note: an English translation.*)

The enclosure includes a copy of the material covered by the catalog entry plus a copy of the front matter of the book in which the material appeared. Inasmuch as Boksan wrote several books about Tesla, it was my thought that you may want to more precisely identify the book in question.

The remaining four enclosures pertain to materials that I am not certain are in the Tesla-Scherff papers at the Library. They should be, inasmuch as I obtained the enclosure copies while the papers were in the hands of Marianna Garner -- the provenance antecedent.

Enclosure 2 is a copy of the first page (I don't have the remainder) of a letter to George Scherff from some family member in Germany. Note that Tesla is mentioned. Little is known about George Scherff, and this letter is important from the standpoint of helping to provide such information. Also, the substance of the letter could be important insofar as information concerning Tesla's business affairs. Is this in the Library's collection? (If so, I would like to have a complete copy.)

note
also

Enclosure 3 is a copy of a letter to George Scherff from Fritz Lowenstein. Note that Tesla is mentioned. This letter is important because of the fact that Lowenstein was Tesla's assistant at Colorado Springs in 1899 where Tesla performed experiments that startled the scientific world, and also worked for Tesla again at his laboratory in Shoreham when he (Lowenstein) returned from Germany. Lowenstein is a controversial figure in Tesla's biography because he (Lowenstein) had agreed to testify in support of the Tesla radio patents in an important case during WWI, but at the last minute switched to support the Marconi radio patents -- raising many unanswered questions about his integrity and provoking the wrath of Tesla's scorn. Is this item in the Library's collection?

Enclosure 4 is a copy of a note to George Scherff from the Office of the Secretary of State of New York. The Library's catalog describes several several stock certificates, incorporation statements, etc., each cited individually, but this item is not included. Is the item, in fact, in the Library's collection?

note
also

Enclosure 5 described a correspondence group (11 items) between George Scherff and the Wisconsin Electric Company. The story behind this group is that Tesla used Scherff to write as himself (to conceal his direct involvement) in order to obtain a special motor of his design. This situation becomes apparent as one reads the correspondence and various marginal notes -- the motor diagram (attached to March 29, 1918, letter) is in Tesla's hand. Is this correspondence group in the Library's collection?

If some (or none) of the items described by Enclosures 2 through 5 are in the Library's collection, do you know where they may be? Were they turned back to Mary Benjamin as nonrelevant, for example?

I will be most pleased to receive your comments.

Sincerely,

Leland Anderson
Leland Anderson
2525 South Meade Street
Denver, CO 80219

It may interest Drago to know that there are some plans and negotiations under way to make a film on Tesla. I understand Hollywood is negotiating with the heirs of John O'Neil for the rights on his book. Seems it will be Todd's outfit -- the guy that is dickering to make "War or Peace" according to the papers. Some months ago I spoke on the phone to a young lady in NY who some years ago wrote Drago a letter asking about rights to make a film of Tesla. If he remembers I forwarded the letter to him in Belgrade. I think it was

DRAGO RUBIN

NIKOLA TESLA

OTKRICE U BUDIMPESTI — POTESKOCE U STRASSBURGU —
KOD EDISONA — NOĆ KUŠNJE I SLAVE — SJENE U LOVO-
RIKAMA — U RODITELJSKOM DOMU — VECERA U HOTELU
ASTORIJA — NA VISORAVNI COLORADA — U KULI NA LONG
ISLANDU — POSJET FRAKOVA — POZDRAV DOMOVINI

Din 30.--

FRITZ LÖWENSTEIN
INGENIEUR.

FRANKFURT A. M. DEN 13. I. 1902.
Kronprinzenstrasse 26.

Sehr geehrter Herr Scherff !

Heute zurückgekehrt von der Jagd nach Herrn Director Singer
beile ich mich Ihnen mitzutheilen, dass ich von demselben die
Zustimmung zur vorzeitigen Lösung meines Contractes erhielt.
Wir sind nun fest darüber, einen Nachfolger für meinen Posten
zu bekommen und hoffe ich, dass derselbe im Laufe der nächsten
Woche wird eintreffen können. Die Geschäftsübergabe werde ich
dann sehr beschleunigen, kann jedoch den Zeitpunkt meiner
Abreise heute noch nicht fixieren. Jedesfalls aber bin ich vor
Ende Februar bei Ihnen, worauf ich mich schon sehr freue.

Die Sendung von 250 Dollar, die ich hie mit bestätige und
für welche ich Herrn Tesla meinen besten Dank sagen lasse, dürfte
bereits mehrere Tage hier am Postamt meiner geharrt haben.

Ich bitte Sie Herrn Tesla meine höflichste Empfehlung bestel-
len zu wollen.

Mit vielen Grüßen und dem Zuruf "Auf ein recht arbeitsfreudiges
Wiedersehen " Ihr

Fritz Löwenstein

LOUIS H. HAMILTON
PRESIDENT & GEN. MGR.

CHESTER H. BEACH
VICE PRESIDENT

ARTHUR HUGONIN
SECY & TREAS.

WISCONSIN ELECTRIC COMPANY

INCORPORATED

ELECTRICAL DUMORE SPECIALTIES

CABLE ADDRESS
"DUMORE RACINE"

RACINE, WISCONSIN July 20th, 1918.



MANUFACTURERS
OF

PORTABLE GRINDERS

SEWING MACHINE
MOTORS

FRACTIONAL
H. P. MOTORS

POLISHERS AND
BUFFERS

ELECTRIC DRILLS

CLOTH CUTTERS

VACUUM CLEANERS

BILLIARD TABLE
CLEANERS

CLOTHES CLEANERS

ERASER CLEANERS

BLOWERS

HAIR DRYERS

SHOE DRYERS

DRINK MIXERS

Mr. George Scherff,
17 Battery Place,
New York City, N.Y.

Dear Sir:-

We forwarded to you yesterday your Motor wound as you requested. It went forward C.O.D. for the reason that we have no means of knowing who you are and what credit you are entitled to. We hope that our action will meet with your approval, and that you can establish with us sufficient evidence for credit.

We hope that the Motor will meet your requirements, and after you have examined it, if there are any further corrections to make on it, if you will return it to us, we will be glad to go into the matter with you further.

At the present time we are busily engaged in Government work and are not giving much attention to this kind of work. However, if you will be patient, we assure you that we will give it our spare time and are most willing to help you.

The price we have quoted you is list for this type of motor, and should orders for quantities be placed, we can quote you more attractively.

Thanking you, we remain

Very truly yours,

WISCONSIN ELECTRIC CO.

PER

RIP:P

R. E. Case

LOUIS H. HAMILTON
PRESIDENT & GEN. MGR.

CHESTER H. LEACH
VICE PRESIDENT

ARTHUR HUGUNIN
SECR. & TREAS.



WISCONSIN ELECTRIC COMPANY

INCORPORATED

ELECTRICAL DUMORE SPECIALTIES

RACINE, WISCONSIN

June 24th, 1918.

MANUFACTURERS
OF

PORTABLE GRINDERS

SEWING MACHINE
MOTORS

FRACTIONAL
H. P. MOTORS

POLISHERS AND
BUFFERS

ELECTRIC DRILLS

CLOTH CUTTERS

VACUUM CLEANERS

BILLIARD TABLE
CLEANERS

CLOTHES CLEANERS

ERASER CLEANERS

BLOWERS

HAIR DRYERS

SHOE DRYERS

DRINK MIXERS

Mr. Geo. Scherff,
17 Batter Place,
New York City, N.

Dear Sir:-

Your letter of the 18th inst.,
is at hand, regarding the building of a
special motor for you.

We have given the information
enclosed in your letter to our Engineers,
who says this enlightens the proposition
considerably, and they may be able to build
a motor that will meet with your requirements.

When anything further develops,
we will notify you to that effect.

Very truly yours,

WISCONSIN ELECTRIC CO.

PER

R. E. Chase

RIP:P

June 18, 1918.

Wisconsin Electric Company,
Racine, Wisconsin.

Gentlemen:-

I beg to acknowledge receipt of your favor of June 7th, and note that your engineers find it impossible to build a motor with the amperage I specified. In this regard I would say, that it will be immaterial what amperage the motor consumes, the only requirement is that the motor should not overheat under the conditions that it will be used. From my former descriptions you will see that the motor will be at rest most of the time and will operate only occasionally when the arc carbons need feeding. I am not interested in the efficiency of the machine and the power required will be very small.

I have no doubt that your engineers will be able to meet these conditions and hope to hear further from you soon.

Yours very truly,

LOUIS H. HAMILTON
PRESIDENT & GEN. MGR.

CHESTER H. BEACH
VICE PRESIDENT

ARTHUR HUGUNIN
SECTY & TREAS.

WISCONSIN ELECTRIC COMPANY

INCORPORATED

ELECTRICAL DUMORE SPECIALTIES

CABLE ADDRESS
"DUMORE RACINE"

RACINE, WISCONSIN

June 7th, 1918.



MANUFACTURERS
OF

PORTABLE GRINDERS

SEWING MACHINE
MOTORS

FRACTIONAL
H. P. MOTORS

POLISHERS AND
BUFFERS

ELECTRIC DRILLS

CLOTH CUTTERS

VACUUM CLEANERS

BILLIARD TABLE
CLEANERS

CLOTHES CLEANERS

ERASER CLEANERS

BLOWERS

HAIR DRYERS

SHOE DRYERS

DRINK MIXERS

Mr. Geo. Scheriff,
17 Battery Place,
New York City

Dear Sir:-

We received your letter of June 3rd referring to a special motor that we contemplated building for you. The writer has taken this with the Engineers for the third time. We will advise that they will make another effort to make this motor. They state, however, that it is an impossibility to build a motor with the amperes you require. Could you make any better suggestions of this part of the wind up? If you have any good points in building this motor, we would like to have you give them to us. It would perhaps greatly help us in our further experiments.

Our shop is also crowded with a good many Government orders, and are not free to devote much of our time to special work. We will, however, give this order our consideration at a very early period.

Very truly yours,

WISCONSIN ELECTRIC CO.

PER

RIP:P

Our interest in efficiency and loss of machine. We will be as rest most of time. We will make that will not overheat machine these conditions.

WISCONSIN ELECTRIC COMPANY

Racine, Wis. June 7, 1918.

Mr. Geo. Scherff,
17 Battery Plc., N.Y.C.

Dear Sir:

We have your letter of June 3rd, referring to the special motor that we contemplated building for you. The writer has taken this up with the Engineers for the third time, and will advise that they will make another effort to make this motor. They state, however, that it is an impossibility to build a motor with the ampere you require. Could you make any better suggestions of this part of the winding? If you have any good points in building this motor, we would like to have you give them to us. It would perhaps greatly help us in our further experiments.

Our shop is also crowded with a good many Government orders, and we are not free to devote much of our time to special work. We will, however, give this order our consideration at a very early period.

Very truly yours,

Wisconsin Electric Co.

(Signed) By R. I. Pease

Dear George:

Please call me up
to-night about this -

Respectfully

Pa

June 3, 1918.

Wisconsin Electric Company,
Racine, Wisconsin.

Gentlemen:-

I beg to acknowledge receipt of your favor of May 28th, and note your remark, that the special motor wound according to my specifications would not develop sufficient power to be of any service. I do not know, of course, under what conditions you have operated the motor, but the fact is, that I have thoroughly tested the idea and wound a motor myself some time ago in the same power, which operated satisfactorily in connection with my arc controller. I feel confident, therefore, if you would send me the motor that you have constructed and give me an opportunity to test it, that it would be satisfactory. What I want is to find somebody who will make these machines for me in quantity, as I have not the necessary facilities; the other parts of the arc controller I intend to manufacture myself.

Hoping to hear further from you at an early date, I remain,

Yours very truly,

LOUIS H. HAMILTON
PRESIDENT & GEN. MGR.

CHESTER H. BEACH
VICE PRESIDENT

ARTHUR HUGUNIN
SECY & TREAS.



WISCONSIN ELECTRIC COMPANY

INCORPORATED

ELECTRICAL DUMORE SPECIALTIES

RACINE, WISCONSIN

May 28, 1918.

MANUFACTURERS
OF

PORTABLE GRINDERS

SEWING MACHINE
MOTORS

FRACTIONAL
H. P. MOTORS

POLISHERS AND
BUFFERS

ELECTRIC DRILLS

CLOTH CUTTERS

VACUUM CLEANERS

BILLIARD TABLE
CLEANERS

CLOTHES CLEANERS

ERASER CLEANERS

BLOWERS

HAIR DRYERS

SHOE DRYERS

DRINK MIXERS

Mr. George Scheriff
17 Battery Place,
New York, New York

Dear Sirs:-

We have your letter of the 23rd
referring to a special wound motor that we were
to build for you.

No doubt our reply to your pre-
vious letters has not yet reached you. We
regret to inform you that we cannot serve you
with this kind of a motor. Our Engineers attempted
to build the motor of this kind, and report that
they were unsuccessful in building a motor as you
have outlined, that would develop sufficient power
to be of any service.

Very truly yours,

WISCONSIN ELECTRIC COMPANY

RIP/HCS

PER

May 23, 1918.

Wisconsin Electric Company,
Facine, Wisconsin.

Gentlemen:-

I beg to refer you to my letter of April 23rd and previous correspondence on the subject of a specially wound motor, which you were to make for me, and inquire when I may expect to receive this machine. There is a large demand for device in which this motor is to be used, I am very anxious to start the business and shall be obliged if you will do what you can to make an early delivery.

Yours very truly,

April 23, 1918.

Wisconsin Electric Company,
Racine, Wisconsin.

Gentlemen:-

Your favor of April 4th reached me only to-day on account of my absence from the City.

I thank you for your readiness to make up the special motor for me and in reply to your questions wish to say the following.

The machines are to be used in connection with arc controllers for moving picture machines and projection lamps. In practice one of the field windings is connected across the arc and the other across a rheostat in opposite direction, so that when the current through both circuits is equal, the magnetizing effect will be annulled and the motor will be at rest. When, however, the carbons burn away, the current through one of the circuits will preponderate, the motor will start and operate the carbon feeding mechanism, feeding the carbons together until the current through both circuits is again equal. The motor, therefore, should have a strong starting torque with a weak field.

I should like you to use for this winding one of your universal motors, so that I may be able to make some tests with it on D.C. as well as A.C. The motor will rotate in both directions to take care of any change in the line voltage. In my experiments I have used a small motor of about the size of those used for mixing drinks, and I think that your Type C motor will be of sufficient power at the normal speed. The shaft extension on this motor is of sufficient length.

Trusting that with this additional information you will be able to make up the motor for me, and hoping to hear further from you soon, I remain,

Yours very truly,

C O P Y

WISCONSIN ELECTRIC CO.,
RACINE, WISCONSIN.

April 4, 1918.

Mr. George Scherff,
17 Battery Place,
New York City.

Dear Sir:

Your letter of March 29th, is received
in reply to ours of March 25th.

We have given this drawing to our engineer
who reports that the diagram is very clear, but for our
information we must know the following:

What current is to be wound for: A.C. or
D.C.? What direction of rotation is necessary and what is
the approximate H.P. required at any given speed? Is the
shaft extension on the Type C of the correct length?

It would further aid us in building this motor
if you know, and if you care to tell, what you are using this
machine for.

We would state definitely that we will be glad
to build this motor for you.

Thanking you to give us this information, we
remain,

Very truly yours,
Wisconsin Electric Co.

March 29, 1918.

Wisconsin Electric Company,
Racine, Wisconsin.

Gentlemen:-

I beg to acknowledge the receipt of your favor of March 25th, in reply to my letter of the 21st. I find that I have not made myself clear, as you do not seem to have understood my question. I am aware, of course, that you do not have differentially wound motors in stock, and my inquiry had the purpose of asking, if you would be willing to make up such a machine for me. What I need is merely a special field winding on one of your regular motors, and I enclose a diagram showing this winding. The fields should be wound with two wires, both wires being wound at the same time, thus making two coils for each field. One set of these field coils should be connected in series - see circuit A of diagram - and the other set should be connected in series with the armature - see circuit B of diagram - and the four terminals brought out. Another important requirement is, that each one of the circuits A and B should take no more than about one-twentieth ampere on a 60 volt circuit. I believe that your type C motor would suit my purpose, if it is possible to get the required field windings into this motor, otherwise a type D motor will do. Your engineer, of course, will have no difficulty in determining this from the data given.

I beg to enquire again, if you are willing to make up this machine for me for a test, and if so, let me know your price

Wisconsin Electric Co. Mar. 29, 1918. -2-

of the same in lots of one, two and three hundred.

Your machine has been recommended to me by Mr. Nikola Tesla, and therefore I should like to use it in connection with my controllers.

Yours very truly,

Encl.

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March 21, 1913.

Wisconsin Electric Company,
Racine, Wisconsin.

Gentlemen:-

Your address has been furnished me by Mr. Nikola Tesla, whom I consulted concerning a specially wound motor which I require. What I need is a differentially wound motor of a fractional horse-power, and I beg to inquire if you would be willing to make up such a machine for me. If so, kindly send me a pamphlet showing the sizes and types of motor you manufacture and I shall send you full specification.

The motor is intended for use in connection with a new kind of circuit controller, for which there seems to be a considerable market.

Yours very truly,

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TESLA, Nikola;

1857 in

Electrician, inventor; b. Smiljan, Lika, border country of Austria-Hungary; son of a distinguished Greek clergyman and orator, and of Georgiana Mandic, a famous woman and inventor, whose father was also an inventor; ed. in elementary school of native place, 4 years in public school in Gospić, Lika, 4 years in Lower Real School, Gospić, and 3 years in Higher Real School, Carlstadt, Croatia, where was grad. 1873. Originally destined for the clergy, but prevailed upon parents to send him to the Polytechnic School in Gratz, where for four years he studied mathematics, physics and mechanics, following with two years in philosophical studies at Univ. of Prague, Bohemia. Began his practical career, 1881, in Budapest, Hungary, where he made his first electrical invention, a telephone repeater, and conceived the idea of his rotating-magnetic field; thence went to France and Germany, where was successively engaged in various branches of engineering and manufacture; since 1884, in U.S., of which is a naturalized citizen. Author of numerous scientific papers and addresses. Among his inventions and discoveries are: System of arc lighting, 1886; Tesla Motor, and system of alternating current power transmission, popularly known as 2-phase, 3-phase, multiphase and polyphase systems, 1888; system of electrical conversion and distribution by oscillatory discharges, 1889; generators of high-frequency currents and effects of these, 1890; transmission of energy through a single wire without return, 1891; the Tesla Coil or Transformer, 1891; novel system of electric lighting by Tesla tubes, 1891; investigations of high-frequency effects and phenomena, 1891-93; system of wireless transmission of intelligence, 1893; mechanical oscillators and generators of electrical oscillations, 1894-95; researches and discoveries in radiations, material streams and emanations, 1896-98; high-potential magnifying transmitter, 1897; system of transmission of power without wires, 1897-1900; economic transmission of energy by refrigeration, 1898; art of Telautomatics, 1898-99; discovery of stationary electrical waves in the earth, 1899; burning of atmospheric nitrogen, and production of other electrical effects of transcending in-

He is a resident

He is the

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NIKOLA TESLA, Electrician, Physicist and inventor, born 1857 in Smiljan, Lika, border country of Austria-Hungary, as the son of a distinguished Greek clergyman and orator, and of Georgiana Mandic, a famous woman and inventor, whose father was also an inventor. His education began in the elementary school of his native place, continued four years in the public school in Gospić, Lika; four years in Lower Real School in Gospić, and three years in Higher Real School, Carlstadt, Croatia, where he was graduated in 1873. Originally he was destined for the clergy, but prevailed upon his parents to send him to the Polytechnic School in Gratz, where for four years he studied mathematics, physics and mechanics, following with two years in philosophical studies at the University of Prague, Bohemia. He began his practical career 1882, in Budapest, Hungary, where he made his first electrical invention, a telephone repeater, and conceived the idea of his rotating magnetic field; thence he went to France and Germany, where he was successively engaged in various branches of engineering and manufacture; since 1884 he is a resident in the United States, of which he is a naturalized citizen.

Mr. Tesla is the author of numerous scientific papers and addresses, and honorary or regular member of many scientific societies, institutions and academies in the United States and abroad; he is a life member of the British Association for the advancement of Science and a Fellow of the Royal Institution of Great Britain; M. A. of Yale and L.D.S. of Columbia, both degrees being honorary, and a Doctor of Science of the Vienna Polytechnic School, the latter distinction being conferred upon him in acknowledgment of his discoveries of the principles of wireless power transmission; the Elliott Cresson gold medal was awarded him in recognition of original work first presented before the Franklin Institute and the National Electric Light Association in 1893, in which wireless transmission was one of the most important chapters.

Among his inventions and discoveries are: System of arc-lighting, 1886; Tesla motor and system of alternating current power transmission, popularly known as two-phase, three-phase, multi-phase or poly-phase systems, which have created

a revolution in electrical engineering, and are now universally adopted (1888); system of electrical conversion and oscillation by oscillatory discharges, 1889; generators of high-frequency currents and effects of these, 1890; transmission of energy through a single wire without return, 1891; the Tesla coil or transformer, which has proved an indispensable adjunct in wireless transmission, 1891; investigations of high-frequency effects and phenomena, 1891 - 93; system of wireless transmission of intelligence, 1893; mechanical oscillators and generators of electrical oscillations, 1894-95; his researches and discoveries in novel radiations, material streams and emanations, ^{were} published in a series of papers in the Electrical Review, New York, 1896 - 1898, in which he announced all the salient phenomena later attributed to radium; high-potential magnifying transmitter, 1897; system of transmission of power without wires, 1897 - 1905; economic transmission of energy by refrigeration, 1898; art of Telautomatics, 1898-99; discovery of stationary electrical waves in the earth, 1899; burning of atmospheric nitrogen, and production of other electrical effects of transcending intensities, 1899-1900; method and apparatus for magnifying feeble effects, 1901-1902; art of individualization, 1902-1903; the development of his system of world-telegraphy and telephony and of the transmission of power without wires has engaged much of his attention since that time. A number of discoveries in the electrical field made by Mr. Tesla, ^{but} which he has not yet announced, he considers of greater importance than any electrical work he has so far done. His most important recent work is the discovery of a new mechanical principle, which he has embodied in a great variety of machines, as reversible gas and steam turbines, pumps, blowers, air compressors, water turbines, mechanical transformers and transmitters of power, hot-air engines, etc. This principle enables the production of prime movers capable of developing ten horse-power, or even more, for each pound of weight. By their application to aerial navigation, and the propulsion of vessels high speeds are practicable, and the results so far obtained are very promising.

a revolution in electrical engineering practice and are now universally adopted
[1888]; novel system of electric lighting by Tesla tubes, 1891;

MECHANICAL THERAPY

THE THERAPY

In order to convey a clear idea of the significance and revolutionary character of this discovery it is indispensable to make a brief statement regarding ELECTRICAL THERAPY.

Fifty years ago, while investigating high frequency currents developed by me at that time, I observed that they produced certain physiological effects offering new and great possibilities in medical treatment. My first announcement spread like fire and experiments were undertaken by a host of experts here and in other countries. When a famous French physician, Dr. D'Arsonval, declared that he had made the same discovery, a heated controversy relative to priority was started. The French eager to honor their countryman, made him a member of the Academy, ignoring entirely my earlier publication. Resolved to take steps for vindicating my claim, I went to Paris, where I met Dr. D'Arsonval. His personal charm disarmed me completely and I abandoned my intention, content to rest on the record. It shows that my disclosure antedated his and also that he used my apparatus in his demonstrations. The final judgment is left to posterity.

Since the beginning, the growth of the new art and industry has been phenomenal, some manufacturers turning out daily hundreds of sets. Many millions are now in use throughout the world. The currents furnished by them have proved an ideal tonic for the human nerve system. They promote heart action and digestion, induce healthful sleep, rid the skin of destructive eruptions and cure colds and fever by the warmth they create. They vivify atrophied or paralyzed parts of the body, allay all kinds of suffering and save annually thousands of lives. Doctors in the profession have assured me that I have done more for humanity by this medical treatment than by all my other discoveries and inventions. Be that as it may, I feel certain that the MECHANICAL THERAPY, which I am about to give to the world, will be of incomparably greater benefit. Its discovery was made accidentally under the following circumstances.



- 2 -

I had installed at the laboratory, 35 South Fifth Avenue, one of my mechanical oscillators with the object of using it in the exact determination of various physical constants. The machine was bolted in vertical position to a platform supported on elastic cushions and, when operated by compressed air, performed minute oscillations absolutely isochronous, that is to say, consuming rigorously equal intervals of time. So perfect was its functioning in this respect that clocks driven by it indicated the hour with astronomical precision. One day, as I was making some observations, I stepped on the platform and the vibrations imparted to it by the machine were transmitted to my body. The sensation experienced was as strange as appreciable, and I asked my assistants to try. They did so and were mystified and pleased like myself. But a few minutes later some of us, who had stayed longer on the platform, felt an unspeakable and pressing necessity which had to be promptly satisfied, and then a stupendous truth dawned upon me. Evidently, these isochronous rapid oscillations stimulated powerfully the peristaltic movements which propel the food-stuffs through the alimentary channels. A means was thus provided whereby their contents can be perfectly regulated and controlled at will, and without the use of drugs, specific remedies or internal applications whatever.

When I began to practice with my assistants MECHANICAL THERAPY we used to finish our meals quickly and rush back to the laboratory. We suffered from dyspepsia and various stomach troubles, biliousness, constipation, flatulence and other disturbances, all natural results of such irregular habit. But after only a week of application, during which I improved the technique and my assistants learned how to take the treatment to their best advantage, all these forms of sickness disappeared as by enchantment and for nearly four years, while the machine was in use, we were all in excellent health. I cured a number of people, among them my great friend



- 3 -

Mark Twain whose books saved my life. He came to the laboratory in the worst shape suffering from a variety of distressing and dangerous ailments but in less than two months he regained his old vigor and ability of enjoying life to the fullest extent. Shortly after, a great calamity befell me: my laboratory was destroyed by fire. Nothing was insured and the loss of priceless apparatus and records gave me a terrific shock from which I did not recover for several years. The enforced discontinuance of MECHANICAL THERAPY also caused me deep regret. I had evolved a wonderful remedy for ills of inestimable value to mankind and invented apparatus offering unbounded commercial possibilities but when I came to consider practical introduction I realized that it was entirely unsuitable. It was big, heavy and noisy, called for a continuous supply of oil, part of which was discharged in the room as fine spray; it consumed considerable power and required a number of objectionable accessories. During the succeeding years I made great improvements and finally evolved a design which leaves nothing to be desired. The machine will be very small and light, operate noiselessly without any lubricant, consume a trifling amount of energy and will be, to my knowledge, the most beautiful device ever put on the market. The intention is to exhibit it in action at the occasion of my annual reception in honor of the Press which has been, unfortunately, delayed this year, and I anticipate that it will elicit great interest and receive wide publicity. Unless I am grossly mistaken it will be introduced very extensively and, eventually, there will be one in every household.

The practical application of MECHANICAL THERAPY through my oscillators will profoundly affect human life. By insuring perfect regularity of evacuations the body will function better in every respect



and life will become so much safer and more enjoyable. One of the most important results will be the great reduction -- amounting possibly to seventy-five per cent -- in the number of heart failures, which are mostly caused by some acute upset of the digestive process and normal operation of the stomach. Another vital improvement will be derived from the quickened removal of toxic excretions of organs affected by disease. It is reasonable to expect that through this and other healthful actions ulcers and similar internal lesions or abscesses will be cured and relief might be obtained even in case of a cancer or other malignant growth. Skilled physicians and surgeons will be able to perform veritable miracles with such oscillations. They stimulate strongly the liver, spleen, kidneys, bladder and other organs and by these desirable actions they must contribute not a little to well-being. Persons suffering from anemia of any form will be especially helped by the treatment. But the greatest benefit will be derived from it by women who will be able to reduce without the usual tantalizing abstinence, privation, sacrifice of time and money and torture they have to endure. They will improve much in appearance, acquire clear eyes and complexions and it may be safely predicted that long continued treatment will bring forth feminine beauty never seen before. It is not to be forgotten that the elimination of countless drugs, patent medicines and specific remedies of all kinds taken internally, by which millions of people doom themselves to an early grave, will be of untold good to humanity.

THE NEW TESLA ELECTRIC HEATER.

STRICTLY CONFIDENTIAL.

This device is greatly superior to the usual flat coil type in efficiency and other respects. It consists of a thin polished metal tube acting as reflector and a base equipped with switch and connecting terminals, and carrying spaced resistor wires concentric with the tube and at a certain distance from the inner surface of the same. In this arrangement the diffuse radiation is virtually eliminated, and the heater operates as if the resistor were not present, the rays being projected from the reflector radially to the central or focal region occupied by the boiling pot.

The principal advantages thus secured are the following:

1. A very high efficiency, as much as 96% being attainable.
2. The efficiency is practically the same whether the pot is large or small, since the density of the rays is inversely as the diameter of the vessel.
3. Due to these features the current consumption is hardly more than half of that in the best heaters of the type referred to.
4. The resistor has a relatively much longer life and can be made to last almost indefinitely in some cases. Also less wire can be used if desired.
5. The heat being largely confined to the range, the kitchen remains comparatively cool.
6. Another practical advantage is greater safety from a variety of accidents frequently occurring with ordinary ranges.
7. The new heater is especially adapted for use on shipboard, Pullman cars, aerial vehicles and automobiles.
8. Likewise it is suitable for all kinds of service on the table, being free from the objections of the present type.
9. It saves considerable time in certain applications.
10. Owing to simplicity, the cost of manufacturing is low.

the subject you wish to write
about. In order to explain this
phenomenon Einstein has
invented the quantity " λ "

My theory of gravitation
explains this phenomenon
perfectly

N. T. April 15. 1932.

We read a great deal about the
cosmic rays matter being
changed into force and force
being changed into matter
by the cosmic rays. This is
absurd. It is the same as
saying that the body can be
changed into the mind, and the
mind into the body. We know
that the mind is a functioning
of the body, and in the same
manner force is a function of
matter. Without a body there
can be no mind, without matter
there can be no force.

Einstein has for years developed
formulas explaining the mechanism
of the cosmos. In doing this he
overlooked an important factor,
namely the fact, namely, that some
of the heavenly bodies are increasing
in distance from the sun. This
is the same as writing for a
business letter and forgetting

PROSPECTUS FOR MR. TESLA'S NITRATES COMPANY.

Discoveries
Mr. Nikola Tesla, whose ~~inventions in high-frequency~~
~~electric currents, which~~ have formed the basis of so many ~~important~~
more recent practical applications of electricity, and which by
~~their world-wide recognition have given this inventor a pre-eminent~~
~~position in the field of electricity, has, by a series of discover-~~
~~ies extending over many years, and all protected by broad patents~~
~~in all the great countries of the world, involved a system for~~
the fixation of atmospheric nitrogen, *that is, its chemical combination with*
oxygen of the nitrogen, ~~or, in other words, for the~~
~~fixation of the nitrogen~~, the oxygen of the ^{air} atmosphere into

*has involved
a new and
efficient
process for*

~~a fixed compound (nitric acid or its compounds), which, by its~~
tremendous value and wide-reaching influence, bids fair to outrank
many times his wonderful invention of the alternating current motor.

~~Mr. Tesla in a field peculiarly his own, has discovered -~~ (over)

First, that his high-frequency electric discharges in
the atmosphere give in a much more effective degree a peculiar
electric chemical stress, which brings about this most difficult
of combinations; a stress which all workers in this field have
recognized for years as being one which not only must be of
tremendous power, but of almost infinite suddenness. The time
element which has so materially interfered with the success of
other workers in this field, by Mr. Tesla's invention, been
almost entirely removed as an objection.

Second, Mr. Tesla's peculiar means of obtaining phenom-
enally high voltages (amounting to millions of volts) from
apparatus of most moderate dimensions enables him to obtain the

2
+ ~~early~~ ~~the first~~ ~~to~~ recognised the immense possibilities of such a departure, and in 1890 he published a paper in which he made the startling prediction that the electric fixation of atmospheric nitrogen would before long develop into an industry next to that of iron and steel. At that time nothing had been done towards commercial exploitation. Nor was his foresight shown by the fact that in various countries extensive plants have been erected since 1900. In Norway alone the production of ammoniacal fertilizers is estimated at 120,000 tons annually, and fifty million dollars have been already invested in the industry. In the United States alone the production of these fertilizers is estimated at 100,000 tons annually.

on the other hand, the cost of the method and apparatus utilising it is no more than a few percent of the electrical energy of the current, and, owing to the first cost so great, the interest and maintenance charges have rendered the business indifferently attractive to capital.

The fixation or burning of atmospheric nitrogen is effected economically by lightning discharges, which precipitate from four to twenty pounds of nitrogenous compounds per acre per year, an enormous amount when considering their scarcity. This high efficiency is due to the great power, suddenness, length and volume of the discharge, and instant cooling, resulting therefrom.

These ideal requirements are fulfilled in the new ~~Tosli~~ ^{which is the result of years of labor and is now} process, owned by the Tosli Nitrate Company.

The "Tosli Transformer" ^{enables it possible to obtain} ~~enables the production of~~ electrical effects of virtually unlimited power, surpassing even those of lightning, as has been demonstrated in actual experiments by its inventor.

The "high frequency" or so-called ~~Tosli~~ ^{Tosli} currents have the peculiar property of exerting the dormant affinities of nitrogen, causing the gas to combine more readily and with a lower expenditure of energy.

X-T-X-X

attenuated are so necessary for the highest efficiency.

Third, by virtue of the peculiar nature of Mr. Tesla's transformer, he is enabled to produce a certain tonnage of product with such a small amount of apparatus and a consequently reasonable investment as to multiply a thousand-fold, the capacity efficiency of his plant. This item is of vast importance in connection with this subject. Many experimenters have produced nitric acid from the atmosphere and there are now some very large plants engaged in this industry, especially in Norway, that involves upwards of \$50,000,000, and which will absorb some 200,000 horse power when it is fully expended, but without exception all these efforts have resulted in a first cost of apparatus so great that the interest and maintenance alone thereof puts a fixed charge upon each ton of the product that has heretofore rendered the business indifferently attractive to capital. Ignoring, therefore ~~for the moment~~, the increased efficiency ~~claimed by Mr. Tesla~~ of his novel method of burning the atmosphere, and ~~assuming~~ ^{assuming} only that he shall burn it as it has been done before by ~~attested~~ ^{attested} that his devices are applied to the old process, the commercial ~~error~~ ^{error} it will be readily seen that it can reduce the cost of the apparatus secured will still be such as to make the success of the project absolutely certain. ~~If it can be had at a reasonable price, for~~ ^{assuming} ~~getting to get power at a sufficiently reasonable price to make~~ ^{the process absolutely certain} ~~the process absolutely certain~~ ^{Pure nitric acid} ~~the plant, instead of costing 80-100 dollars per ton of annual product, will cost for an~~ ^{corresponding expenditure of eight dollars, or less.} ~~and its salts (and all nitrates prepared thus from the atmosphere~~ ^{are pure) will sell from \$100. to \$200. per ton, and even the crude} ~~articles of commerce, such as the Chili saltpeter with 5% of~~ ^{impurities, sell for \$55. and better.} ~~impurities, sell for \$55. and better.~~ ^{what a small charge of investment of \$10. per ton of put-} ~~put becomes.~~ ^{such an installation} ~~The operation of these plants, like those of hydri-~~ ^{and care.} ~~acetic installations, require but little labor.~~ ^{There is no essential}

part ^{of the plant} ~~which is subject to rapid wear and tear~~; in fact, most of it is ^{corrosion} good for one hundred years, as it consists principally of brick ^{and metal and is good for centuries.} buildings, transformers, brick or tile combination chambers and equipment, ~~power or their equivalent~~. The process is a continuous one and once started requires no manual labor, ~~the electricity~~ ^{electrical} continuing to burn the atmosphere into nitric fumes, which in turn combine with water to make nitric acid, and this goes on until the ~~current~~ current is switched off, and immediately recommences when ^{the} current is ~~again~~ switched on.

There is no loss upon the discontinuing of the process for an hour, a day, a month or a year, ^{other than} ~~except~~ that ~~is~~ due to ^{the} plant lying idle and carrying its ^{no small} ~~burden~~ of interest. It is obvious, therefore, that it ~~only remains to obtain power at a sufficiently~~ ^{charge} reasonable ^{by the use of this revolutionary process a cost} ~~price~~ to make an almost ~~unlimited~~ industry ~~of this~~ ^{can be built up} with a very reasonable investment of capital yielding annually a return many times the first cost.

The Tesla Nitrates Company owns the exclusive rights under ^{the} ~~the~~ United States patents granted to ~~the~~ Tesla ^{and} applicable to the manufacture of nitrates from the atmosphere, ^{which are the following:} ~~which are the following:~~ ^{It will also own any} ~~and also his future inventions when they shall be made, relative~~ to this subject, ^{improvements, he may make} ~~and will get the benefit of his assistance and advice.~~

^{insert paragraph here} ~~It is proposed to immediately make a demonstration of the~~ ^{thought advisable} ~~salient advantages of the novel process with a model plant~~ on the commercial magnitude in the immediate vicinity of New York

City, where experts and investors may see ^{for themselves} ~~the~~ practical application of ~~these~~ ^{his} inventions, ^{and judge for themselves of their value.} ~~in a full sized unit~~ apparatus. ~~In making this test, Mr. Tesla will have at his~~

~~disposal, a plant that has already cost over \$200,000, a large~~ part of which will be immediately available. ~~It is estimated that~~ ^{will be ample to meet} ~~this test will involve an expenditure of \$25,000~~ ~~from the fund~~

ishing of the additional apparatus, partly for attendance and
all expenses in that connection. Incidentally the plant will serve
operation and partly for the very full and exhausted demonstra-
the important purpose of exhaustively testing the latest improve-
tion which it is proposed to be made.
prior to their application on the large scale contemplated.

XXXX # Tester is now devoting himself to
the perfection of plans for ~~construction~~ ^{installation} a large plant
being assisted in this work by a ~~well known~~
prominent ^{of international repute} engineer who ~~has been for a long time~~
~~has been engaged~~
a long experience in the fixation of nitrogen
by the old method and is thoroughly familiar
with all ~~the~~ facts pertaining to the manufacture
and sale of the products. In the mean-
time X X

Anderson,
Mss 481

TESLA'S NEW SYSTEM OF FLUID PROPULSION

In subduing the forces of Nature to his service man must invariably avail himself of some process in which a fluid acts as carrier of energy, this being an essential step in any industrial undertaking dependent on mechanical power. Evidently then, a discovery or radical departure in that domain must be of extreme importance and far-reaching influence on the existing conditions and phases of modern life.

Fluid propulsion is now effected by means of pistons, vanes or blades, which entail complexity of construction and impose many limi-

tations on the propelling as well as propelled mechanism and its performance. Tesla has dispensed with these devices and produced machines of extraordinary simplicity which, moreover, are in many other respects superior to the old types universally employed. A few words will be sufficient to convey a clear idea of his invention.

Every fluid, as water or air, possesses two salient properties: adhesion and viscosity. Owing to the first it is attracted and clings to a metallic surface; by virtue of the second it resists the separation of its own particles. As an inevitable consequence a cer-

tain amount of fluid is dragged along by a body propelled through it; conversely, if a body be placed in a fluid in motion it is impelled in the direction of movement. The practical forms of Tesla's apparatus consist of flat, circular disks, with central openings, mounted on a shaft and enclosed in a casing provided with ports at the peripheral and central portions. When deriving energy from any kind of fluid it is admitted at the periphery and escapes at the centre; when, on the contrary, the fluid is to be energized, it enters in the centre and is expelled at the periphery. In either case it traverses the in-

terstices between the disks in a spiral path, power being derived from, or imparted to it, by purely molecular action. In this novel manner the heat energy of steam or explosive mixtures can be transformed with high economy into mechanical effort; motion transmitted from one shaft to another without solid connection; vessels may be propelled with great speed; water raised or air compressed; an almost perfect vacuum can be attained, substances frozen and gases liquefied.

While this improvement has the broadness and applicability of a fundamental mechanical concept, the widest field for its

commercial exploitation is, obviously, the thermodynamic conversion of energy.

The commercial value of a prime-mover is determined by its efficiency, specific performance relative to weight and space occupied, cheapness of manufacture, safety and reliability of operation, adaptability to construction in large units, capability of running at high peripheral velocity, reversibility, and a number of other features of lesser importance. In the majority of these a machine, operating on the new principle, excels. But there is one quality which is most desirable in a thermo-dynamic transformer from the

economic point of view, and that is great resistance to deterioration and impairment of efficiency by heat.

The employment of high temperature is of such vital bearing on the efficiency of prime-movers that it is of paramount importance to extend the thermal range as far as practicable. In the present state of the art radical progress towards more economical transformation of the energy of fuel can only be achieved in that direction. Such being the case, the capability of the machine to withstand deteriorating effects of great heat is the controlling factor in determining its commercial value. In that most desired quality the

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Tesla turbine surpasses all the older types of heat motors. The Diesel and other internal combustion engines are fatally limited in this respect by their complete dependence on closely fitting sliding joints and unfailing supply of clean lubricant; while in the present forms of turbines buckets, blades and inherent mechanical deficiencies impose similar restrictions. These parts are too delicate and perishable to serve as elements of a gas turbine and this has been the main obstacle in the way of its successful realization. The rotor of the Tesla turbine presents a relatively enormous

active area and the wear is quite insignificant as the fluid, instead of striking against the propelling organs in the usual destructive manner, flows parallel with the same, imparting its momentum by adhesion and viscosity instead of impact. Moreover it has been shown that the efficiency of this form of rotor is not impaired to any appreciable degree by a roughening of the disks and that it operates satisfactorily even if the working medium is corrosive to an extent.

The universal adoption of steam as motive power under certain standard conditions, settled upon in the course of time, gradually forced upon the minds of engineers the Rankine

Anderson
MS 481

Cycle Efficiency as criterion of performance and long continued endeavors to improve the same have finally resulted in complex multistage constructions entirely unsuitable for high temperatures. The Tesla turbine, by virtue of its exceptional heat-resisting and other unique properties, makes possible the attainment of great fuel economy with but a single stage, incidentally offering the additional advantages of an extremely simple, small, compact, and reliable mechanism. But perhaps the chief commercial value of this new prime-mover will be found in the fact that it can be operated with the cheapest grade of crude oil, colloidal fuel, or powdered coal, containing con-

siderable quantities of grit, sulphur and other impurities, thus enabling vast sums of money to be saved annually in the production of power from fuel.

The Tesla turbine also lends itself to use in conjunction with other types, especially with the Parsons with which it forms an ideal combination. Although its practical introduction has been delayed by the force of circumstances, a number of years have been spent in exhaustive investigations and experiments on the basis of which the performance in any given case can be closely calculated. The first public tests were made before the

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outbreak of the war at the Waterside Station
of the New York Edison Company where several
machines, ranging from 100 to 5000 h.p., were
installed and operated with satisfactory re-
sults. That the invention was appreciated
by the technical profession may be seen from
the excerpts of statements by experts and
periodicals printed on the annexed page.

The salient advantages of the
Tesla turbine may be summed up as follows:

EFFICIENCY: The most economical of the
present prime-movers is the Diesel engine.

But, quite apart of many practical and com-

mercial drawbacks, inseparable from this type, it is entirely dependent on comparatively expensive oil, so that the Tesla Gas Turbine, working with much cheaper fuel, would have the better in competition even if its efficiency as a thermodynamic transformer were appreciably lower, all the more so in view of its greater mechanical perfection.

Referring to turbines, all of which are surpassed by the Parsons in economy as well as extent of use, definite limits have already been reached and the only possibilities of saving fuel exist in the employment of steam at very high superheat

and utilization of gas or oil as motive fuel.

But none of the primemovers mentioned is adapted for such operation and although every effort has been made in this direction, no signal success has been achieved. The superheat is at most 250° F. this being considered the maximum permissible. All attempts to considerably extend the thermal range have failed chiefly because of the inability of bucket structures to withstand the action of intense heat. The Tesla Turbine can operate quite satisfactorily with the motive agent at very high temperature and, owing to this quality,

lends itself exceedingly well to these purposes.

SPECIFIC PERFORMANCE: In this particular it is superior to all other forms. Each disk is virtually the equivalent of a whole bucket wheel, and as many of them take up but a small width the output of the machine, considering its weight and size, is surprisingly great. This, while not being a measure of efficiency, is nevertheless a feature of considerable importance in many instances.

CHEAPNESS OF MANUFACTURE: The new turbine can be produced without a single machined part except the shaft, all the disks being punched

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and the casings pressed. By this method, with proper machinery installed on a large scale, the cost of production may be reduced to a figure never deemed possible in the construction of an engine. What is more, this can be done without material sacrifice of efficiency as small clearances are not essentially required.

SAFETY AND RELIABILITY OF OPERATION: There is an ever present danger in the running of high speed machines. A bucket turbine may at any moment run away and wreck the plant. Such accidents have happened again and again and this

peril has often proved a deterrent to investment.

A remarkable quality of this turbine is its complete safety. As regards the wear and tear of the propelling organs it is significant and, in any event, of no consequence on the performance.

ADAPTABILITY TO CONSTRUCTION IN LARGE UNITS: In all the present machines there is a distinct limit to capacity, for although large units can be manufactured, they are very costly and difficult to manage. The new turbine is so simple and the output so large that the limits in this direction can be greatly extended.

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RESISTANCE TO DETERIORATION BY HEAT AND OTHER

AGENTS:

In this feature again it has an overwhelming advantage over the old types in which the maintenance of smooth surfaces and sharp edges is indispensable to efficient working.

In the Tesla Turbine, for the reasons already stated, the destructive actions of heat and corrosive agents are much less pronounced and of relatively negligible effect. This fact has a most important bearing on the saving of fuel.

CAPABILITY OF RUNNING AT HIGH PERIPHERAL SPEED:

In this respect also it is superior to others. The rotating structure carries no load and is

excellently adapted to withstand tensile stresses. Judging from the most recent turbine practice this quality should be of special value.

REVERSIBILITY: The present turbines are greatly handicapped by their incapability of reversal which is a very serious defect in certain applications, as the propulsion of vessels, necessitating the employment of auxiliary turbines which detracts from the propulsive power and adds materially to the cost of production and maintenance of the equipment. The Tesla Turbine has the unique

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property of being reversible; not only this but it operates with the same efficiency in either direction. For marine purposes it therefore constitutes an ideal motor whether used alone or in conjunction with older types.

Besides the above it possesses other desirable features, constructive and operative, which will add to its value and adaptability to many industrial and commercial uses as, railroading, marine navigation, aerial propulsion, generation of electricity, refrigeration, operation of trucks and automobiles, hydraulic gearing, agriculture, irrigation, mining and similar purposes.

C. B. Richards, Professor Emeritus of Mechanics, Yale University: "I am amazed at the development of power given by the turbine and stunned by the exhibit."
F. Sargent, Chief Engineer and Turbine Expert: "I am impressed with the newness and novelty of the underlying principle of this invention. It is such as will claim the attention and admiration of anyone of a scientific turn of mind in a mechanical direction."
Reynold Janney, Chief Engineer, Universal Transmission Co: "It is a great invention."
Brigadier Allen of the War Department: "Something new in the Officers are greatly impressed with it."
Miller Reese Hutchinson, Chief Engineer: "It is the greatest thing of the age."
Arnold Irinyi, Chief Engineer, Colfeurungs-Gesellschaft, Cerna: "The ideal of the turbine engine."
E. R. T. Collins (Power Plant Economist): "It is a wonderful contribution to science and engineering, great in its simplicity and breadth of application."
The Motor World: "The new principle unquestionably is a great contribution to science and engineering, great in its simplicity and breadth of application."
Scientific American: "Considered from the mechanical standpoint the turbine is astonishingly simple and economical in construction, should prove to possess such a durability and freedom from wear and breakdown as to place it, in these respects, far in advance of any type of steam or gas motor of the present day."
Engineering Magazine: "An entirely new form of prime mover with interesting possibilities."
Technical World Magazine: "The Tesla Turbine is the apotheosis of simplicity. It is so violently opposed to all precedent that it seems unbelievable."

From Numerous Articles and Comments:

"The turbine is different in principle to any heretofore in use and one which will take less room and less coal than the best engine now running".....
"Turbine of revolutionary design"..... "Improvement in dynamics which promises revolutionary results"
"Results seem revolutionary to the point of staggering the imagination"..... "This motor will revolutionize the turbine industry"..... "Wonderful motor"
"Extraordinary mechanical principle"..... etc. etc



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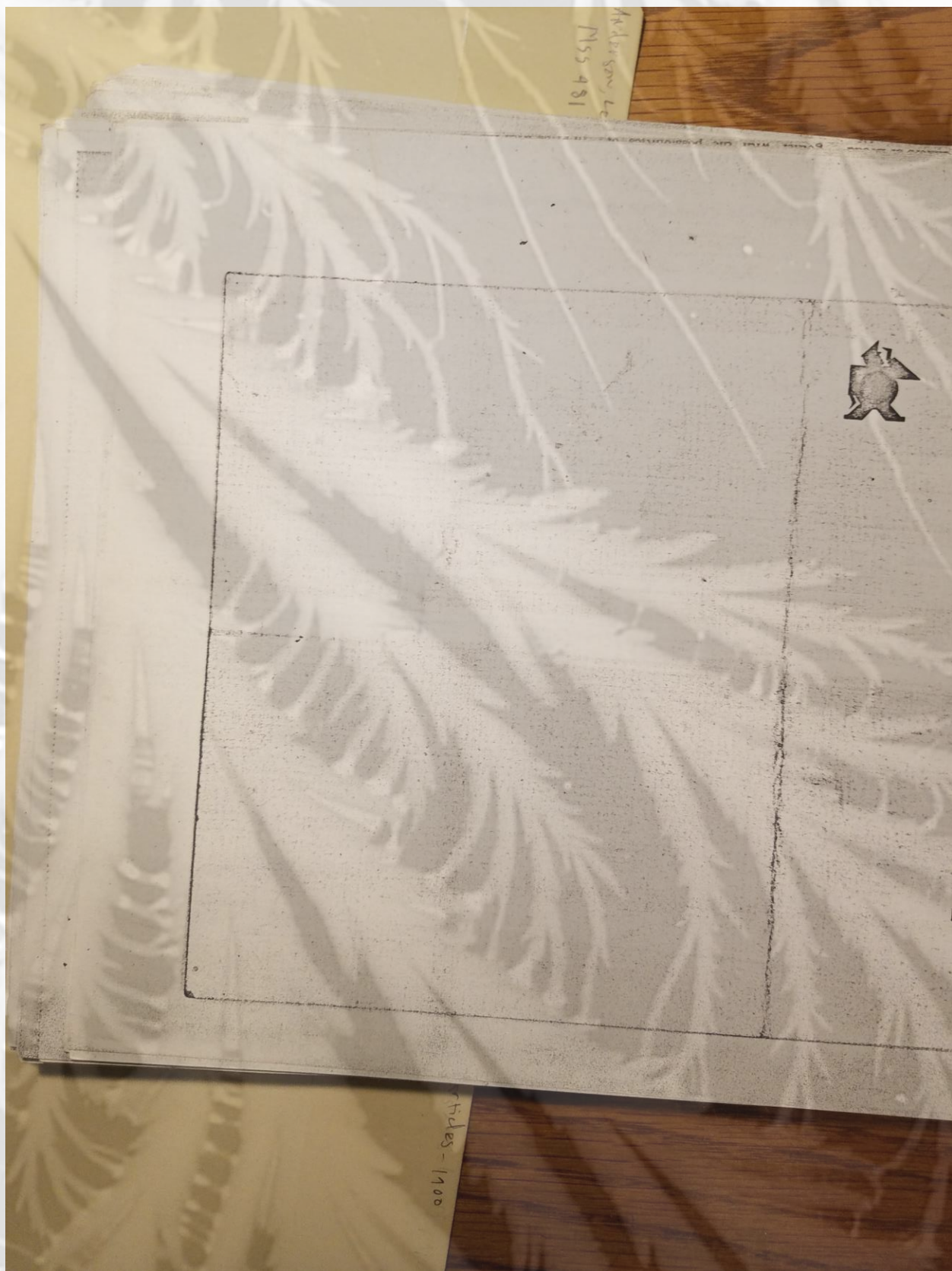
DR. NIKOLA TESLA

on the occasion of his

EIGHTY-FIRST BIRTHDAY



HOTEL NEW YORKER, NEW YORK
SATURDAY JULY 10, 1937



Anderson, L.
MS 481

MS 481-1900

Menu



Amontillado Glace

MELON MIEL ROSÉ



ESSENCE JULIENNE AU TOMATE GELEE

Liebfraumilch



TRUITE DE RIVIERE AUX FINES HERBES
AVEC BROCCOLI EN BRANCHE

Chateau Pontecanet



CANARD EN CASSEROLE A LA TESLA

Cognac Martell



Cordon Bleu

GATEAU SOUVENIR
AVEC FRAISES GENIEVREES
CHATEAU d'YQUEM

Mount Vernon — 1921



Haig & Haig

MOCHA EN DEMI-TASSE

Cigars
Cigarettes

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Amontillado Glass

Liebfraumilch

Chateau Pontecane

Cognac Martell
Cordon Bleu

Mount Vernon — 1921
Haig & Haig

Cigars
Cigarettes

5
Hides - 1902

FOR ACCOMPANIMENT.

Nikola Tesla's world fame is based on the inventions which he made during the last ten years of the past century. They lie in the electrotechnical field, especially in the field of low and high frequency alternating currents, and they are the result of extremely fruitful research work. Since that time there has been developed a mighty and many-sided alternating current industry which is still growing to-day, but Tesla's name is mentioned ever more rarely in connection with this industry, although it is not unknown that he had an eminent part in laying the foundations of the electrical industry.

In this book his countryman, S. Boksan, has collected an abundance of original material about Tesla's life work and discussed it historically and critically in its bearing on the complete development of the electrical industry, so that the book offers a welcome opportunity to gain an inspiring insight into the creative labors of a genius and pioneer of the electrical industry.

Not rarely has the question been raised why, in the modern commercial exploitation of electricity, Tesla does not take the part which might be expected in view of the undimmed greatness of his inventions. Technical men, according to their specialties, judge differently the disappointments which have not been spared to Tesla. For me it lies near to point out, with respect to the field of wireless telegraphy, the manifold variations which our views have undergone in the course of time. The conception of the Hertzian waves has already changed, and that in a sense which

has not been favorable to the appreciation of Tesla's merit in wireless telegraphy.

Originally only such waves as Hertz himself had employed were called Hertzian waves, that is, waves of about one meter in length. The long waves of wireless telegraphy differ from them in many respects. They do not propagate in such straight lines as true Hertzian waves and also do not spread out in free space, but at the surface of the earth. If the description of wireless transmission of energy by means of Hertzian waves is possible was therefore in the first instance at least problematical; and it is probable that Tesla would not have been at all understood, if in the nineties he had explained his results by Hertzian waves.

It was only about the turn of the century that Max Abraham succeeded in proving that the waves emitted by a grounded transmitting conductor, excited by high frequency currents, can be calculated by the same equations as real Hertzian waves; only two limitations were to be made in this connection; first, the earth must not show any electrical resistance and, second, it must be smooth. Although these conditions are in reality only partly fulfilled, the waves of wireless telegraphy have since that time been identified with Hertzian waves; yes, the wireless waves are occasionally even confounded with light waves.

Marcini worked originally with the short Hertzian waves emitted by a Righi Oscillator. When he turned to the use of long waves, in accordance with Tesla's precedent, he could without hesitation describe his propagation processes as Hertzian waves, and only thereby had the correct raiment for

wireless telegraphy been found.

The description of Tesla's work contained in this volume might give numerous suggestions to everybody who looks beyond the far reaching every-day work of the electrical industry and has in view its general progress, and may it thereby serve not only for historical ~~recognition~~ justice, but also for the further development of the electrical industry!

Berlin-Steglitz, March 5, 1932.

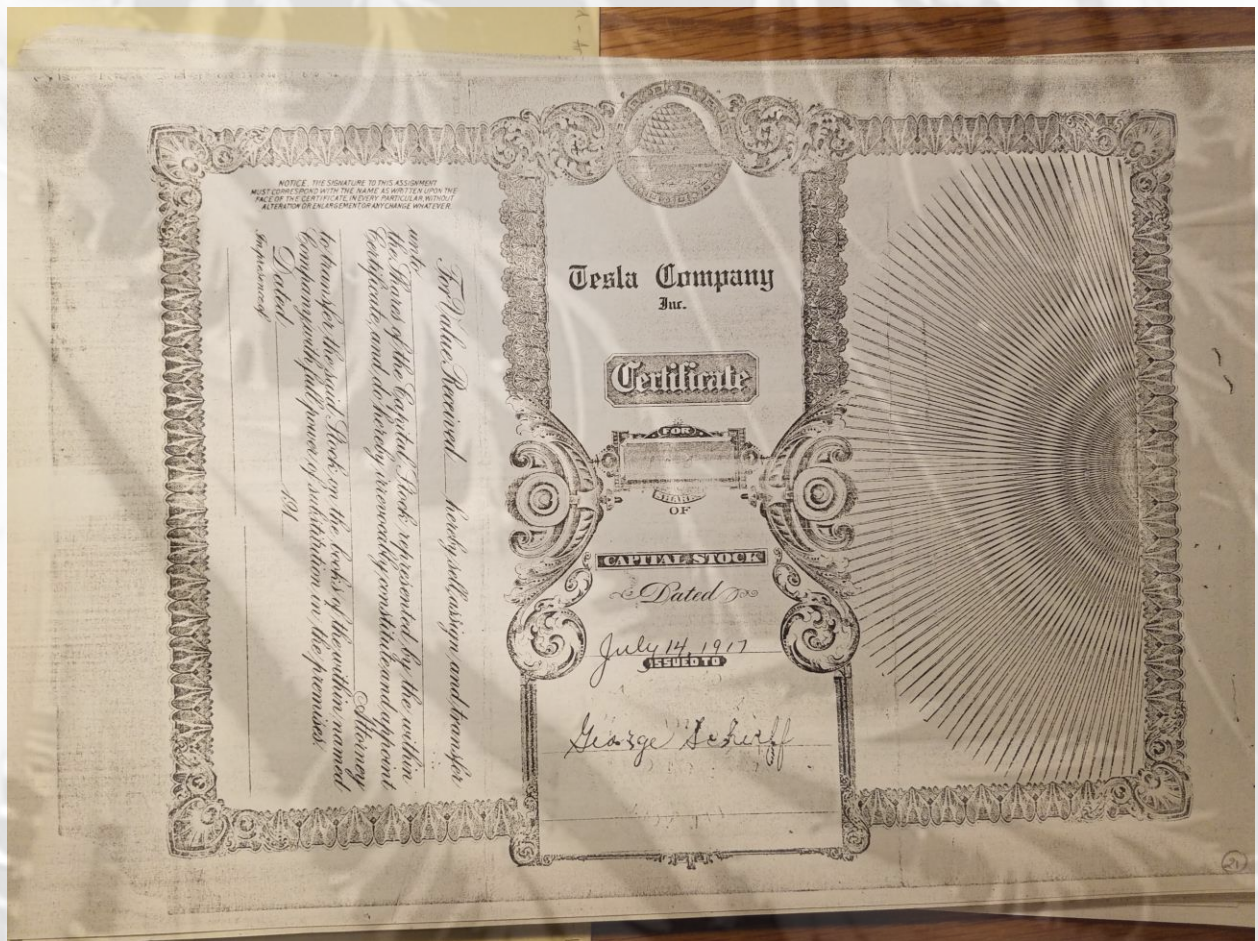
Franz Kiebitz.

P R E F A C E .

The last forty years in the field of electrical engineering have been given their imprint by the polyphase current system, polyphase power transmission and the induction motor. Countless long distance central stations have been erected during this time in the entire world, many millions of horsepower have up to now been developed from water-power, and the development in this direction is gaining ever more in immensity. The transmission of electrical energy to great distances has in a short time become a mighty factor in the economics of electricity as well as in modern engineering and present-day civilization. The foundation for this development was laid in the year 1882, a round fifty years ago, by Nikola Tesla, through his discovery of the rotating magnetic field. Based on this epochal discovery Tesla himself, by intense research work lasting for ten years, made numerous detail inventions and discoveries which, together with his discoveries in the field of high tension technique, were disclosed in more than forty patents and have created the foundation for the great edifice of the present heavy current industry.

Following up this work, Tesla developed in 1890 his high frequency generators, and in 1891 his high frequency transformers, from which he has created in the succeeding years the foundations for high frequency technique and high frequency investigation. His celebrated address in Columbia College before the American Institute of Electrical Engineers on May 20, 1891 was accompanied by scientific experiments





NOTICE: THE SIGNATURE TO THIS ASSIGNMENT
MUST CORRESPOND WITH THE NAME AS WRITTEN UPON THE
FACE OF THIS CERTIFICATE, IN EVERY PARTICULAR, WITHOUT
ALTERATION OR ENLARGEMENT OF ANY CHANGE WHATSOEVER.

To the Order of _____ *hereby assigns and transfers*
with _____ *the share of the Capital Stock represented by the within*
certificate, and do hereby irrevocably constitute and appoint _____ *attorney*
to transfer the said stock on the books of the within named
company with full power of substitution in the premises
Dated _____ *1917*
In presence of _____

Tesla Company
Inc.

Certificate

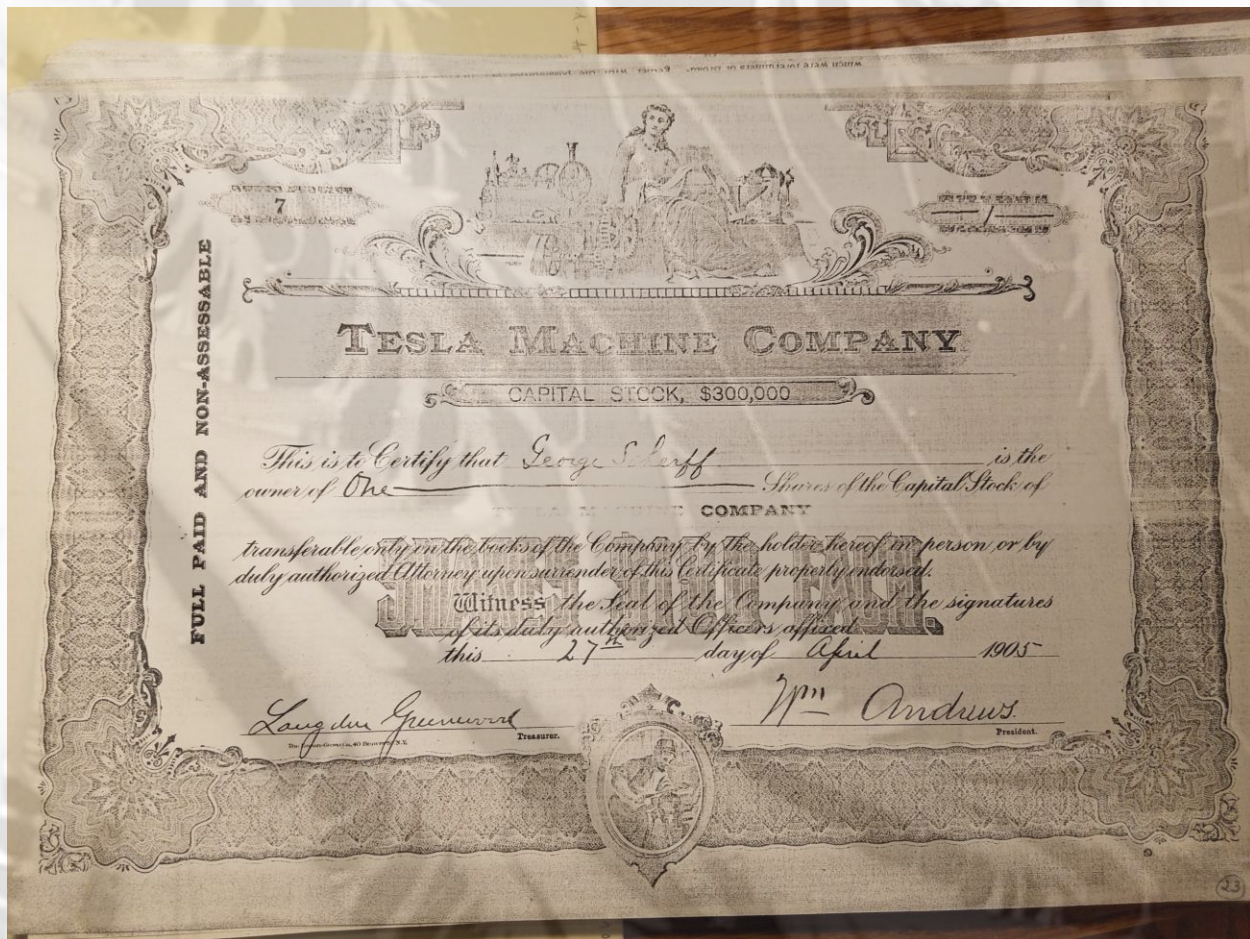
FOR
SHARE
OF

CAPITAL STOCK

Dated

July 14, 1917
RECEIVED

George Scherff



My dear Dr. Scherff,

The most important discoveries in the January 17, 1930
papers have been discussed with you frequently and
these discoveries, I intend to announce soon.

1) The velocity which a planet rotating around
another would attain in falling towards the
latter to its present position from infinity
is equal to its orbital velocity multiplied
with $\sqrt{2}$.

2) The kinetic energy of orbital motion of
a planet rotating around another is
equal to half of that required to carry
the planet place beyond the sphere of attraction
of the second.

Under the laws now supposed of attraction and
some other theories, however.

The present theory that the intensity of attraction
decreases as the distance increases.

Please preserve these papers as references.

Sincerely

W. W. R. R.

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New York, Apr. 19th, 1906.

Mr. Nicholas Tesla,
Waldorf Astoria, C I T Y.

Dear Sir:-

We have your favor of the 16th inst., which confirms telephone instructions to ship to you 2600 ft. of #8 B&SG. rubber insulated and lead covered cable.

Please note we are giving this order best attention in accordance with our quotation of April 16th.

Very respectfully,

FIW/H

STANDARD UNDERGROUND CABLE CO.

W. J. Marsh
GENERAL MANAGER EASTERN
NORTH EASTERN SALES DEPARTMENT

NEW YORK Herald-Tribune
(from type office)

FOR THE SAKE OF THE BIRDS
EMPLOYMENT AGENCY

Tesla doing? We find him feeding pigeons. It is a comforting sight. We make a face at Mr. Wells and we turn our back.

men of the future. And what do we find Mr. Tesla tube, his great achievements in transmission of electricity, is such a scientist, such a Surely Mr. Tesla, with his Tesla cell, his proceed on schedule. antized, automatized world below them will from time to time to touch a button or turn a knob, so that the rationalized, electrified, mechanized, automatonized world below them will ing in atomium towers, stirring themselves giving us pictures of large-domed scientific living been the chief dispenser of these horror stories. by his particular gadget. Mr. H. G. Wells has and when every human problem is contemplated all going to be like, when science has conquered all insurance in the story. For a generation we have There is a special reason why we and reas-

While We Cut Relie
the Budget

selection much easier. only answer: "Ja, we like it To which obedient and help ordered to promote is fish." food market, but the only food tion's members according to the may be offered will be notified former, save food and avoid wast Breesen, to make selection easi will be strictly limited. in o "The number of dishes that i serving food. providing for simplified menu can hotel organization, announced for "Eriz Breesen, head of the r Berlin— Wireless to the New York

Rebuilding the Ro

unintelligible. Air Commerce Bureau's radio (2) Static conditions which did not permit a safe return. "particularly when the area Merrill flight into predicted (1) Improper dispatching lost because of: Bureau, which admits that How big-hearted of tion. ing "without first definite to "forgive" Merrill for to Now the Air Commel and one passenger wer a crash. Merrill, two o Only his adroit h to make a blind la In a heavy fog he transport aiplan

Mr. Nikola Tesla and Mr. H. G. Wells We are greatly reassured about life and living by the week-end story concerning the famous inventor, Mr. Nikola Tesla, the messenger boy and the pigeons in front of the Library. The tale comes like a benediction in a brittle, mechanical world: Mr. Tesla, eighty years old, full of accomplishments and honors, gives the telegraph messenger to scatter corn to the birds twice daily. Mr. Tesla used to do the job himself. But he found it more convenient last winter to deputize the boy. Busy as Mr. Tesla is, he could not forget the ragged wild life of the metropolis and so, day after day, the hand goes out with food, the birds eat and coo and grow fat. There is a special reason why we and reas-

country. In its government and condition lies the secret of its com-ism and of its piety, as of its profoundly owners held more than half the land and 40 per cent of the farm population owned no land at all. In the Basque country the farms are four or five acres each and landless farmers are almost unknown. And the securest safeguard of democracy is a wide distribution of property. Secondly, Church and state have been kept separate from time immemorial in the Basque provinces. The people who gave Catholicism, Ignatius de Loyola and St. Francis Xavier for-bade either clergy (or lawyers) to sit in their Parliaments or to take part in their politics.

WHICH WERE FORGOTTEN IN THE PAST

11- Pa
Tesla

ALTHOUGH the future to Mr. Einstein and others who open time, may be as clear as pi (the mathematical kind), it is to the rest of us, who are still on standard time, as foggy as a London alley. But it is certain that when the survivors of the present age of progress come to write the roster of our great, the name of Nikola Tesla will stand pretty far up on the list. Tesla who predicted radio way back in 1900 now looks forward to sending waves to the moon. Tesla is the sort of scientist that Hollywood and Mr. H. G. Wells love, a mysterious brilliant man who has left our small reality for fourth-dimensional play in gloomy testtube-festooned laboratories. Forty years ago Tesla was toying with electrical discharges of many millions of volts, while today scientists have difficulty in developing a fraction of those potentials for their atom-smashing and X-ray experiments. Long before Marconi, Tesla girdled the earth with giant electrical waves from his high voltage generators.

Tesla plans now to send a veritable Jovian bolt to our neighbor the moon, a beam capable of producing a large incandescent blemish on that pleasant night-time body. This bolt will carry energy waves capable of running machinery (lunar factory sites are going fast, so you'd better hurry). Although Tesla's new mechanism is a secret, it seems—from a little hint here and there—that the basic energy will be supplied by cosmic waves. Now!—if you haven't a shuddery plot doped out for a super-colossal piece featuring Boris Karloff, there's no use telling you any more.

—J. Wentworth Tilden.

Electric Sorcerer

PRODIGAL GENIUS. The Life of Nikola Tesla. By John O'Neill. 326 pp. New York: Grosvenor House, 1914.

By WALDEMAR KAEMPFERT

NIKOLA TESLA stalks the fantastic figure that he was in life—a colubine reclus who sought supreme control over matter and energy, a Dr. Faustus who cared nothing for Marguerites, a philosopher filled with a weird discontent, a poet who toyed with artificial lightning. Though he was not of this world he was something of a bon vivant in his younger days. No one could order a dinner with nicer discrimination, no one had a finer taste in rare vintages, French, English, German, Italian and his native Serbian—he not only spoke them all but quoted their poetry to all who would listen. He lived in hotel rooms most of his life, a hermit in a metropolis, whose tall, lean figure could be seen on Fifth Avenue, sunk in his thoughts, unaware of the salutations of those who knew him, stopping only to feed the pigeons around the Public Library.

To Edison must go credit for having first built central stations, inventing electric lamps and putting us on our electrical feet. Yet not much of Edison's apparatus is left. What we see about us is largely Tesla's. The man was a pioneer who could make a fortune and spend it all on lavish experimenting and who died owing J. P. Morgan, John Jacob Astor, Austin Corbin and others several millions. All were so many rabbits in the intellectual clutch of this fascinating but retractor Newspaper reporters, though they could not understand what he was talking about, were entranced with his proposals to communicate with Mars and to transmit power without wires over vast distances. Tesla knew

how to get publicity, and he liked to pose as an electric sorcerer. He would discuss his projects with apparent reluctance and in the end, as if he were utterly wearied, but only having exhausted the topic, would ask for another drink, talk on billiards or quote Goethe.

LIKE a medieval practitioner of black arts, Tesla was given to mystification. He was the first to talk of "death rays." Once he set up oscillations that shook buildings near his laboratory and brought the police from headquarters. What happened is not clear, for Tesla destroyed the apparatus. The tale reminds one of his contemporary, Kestey, who was largely responsible for the popularly accepted notion that a man playing a violin can shake down a skyscraper. It may be, too, that the generators of the Colorado Springs Electric Company blew out when Tesla on Pike's Peak electrified himself and glowed weirdly. Engineers will wonder why effects that brought disaster to a power house two miles away without benefit of wires did not kill Tesla, and they will doubt if discharges of high voltage but very little amperage could do so much harm. It is not that we question Tesla but that we want more evidence than he ever supplied that an engineer can understand.

Here was a romanticist who should have been born in the Middle Ages. Electrical engineers never fully understood him. His mode of reasoning, his philosophic approach, were so much obscure to them. Even in the one popular article that he wrote over forty years ago for the old Century Magazine he was vague as an oriental mystic.

Soon after he came to this country Tesla was associated briefly with Edison. No greater



Tesla "in the Effulgent Glory of Myriad Tongues of Electric Flames."

contrast can be imagined: Edison, as practical as an Irish foreman of a railway section gang, who affected to despise theorists and mathematicians, though he did not hesitate to employ them; the Serbian, a dreamer to whom most inventions were mere toys, his own included. No wonder the two parted.

Though he lived to be 85, Tesla crowded most of his inventive activity within twenty years. And what activity it was! Polyphase current engineering, the induction motor, the use of oil in transformers, radio, electric arc fed by direct current in a magnetic field, gas-discharge lamps which were forerunners of Broad-

The Future of Flight

THE COMING AIR AGE. By Reginald M. Cleveland and Leslie E. Neville. New York: Whittelsey House, 1914. 359 pp. \$2.75.

By EDWARD WARNER

THERE has been a mighty flood of books on aviation in recent years—books on every aeronautical specialty from navigation to welding, including impassioned polemics on air power. Still it has been difficult to find a single volume that could be recommended to the intelligent voter who sought a comprehensive view, and not an unduly romantic or impressionistic one, of how flight might affect human behavior and the world's economy in years to come.

It is for that voter, rather than for avid youth straining for its own wings, that "The Coming Air Age" is written. The authors have chosen a little-used target, and if they have not quite hit the bullseye, they have come close. Both are well known and long respected counselors to the aircraft industry—Mr. Cleveland who was formerly aeronautical editor of THE NEW YORK TIMES, Mr. Neville as editor of Aviation Magazine.

They have been most successful where they have been most specific. The continuity of the volume is scanty, for a variety of subjects is treated: successive chapters deal with matters ranging from the "economics of pricing" of a world police force. All lie within the province of the title of the book; and some, at least, are the best concise treatments of their subjects that are so far available to the general reader. The chapters which will arouse the quickest interest, those dealing with air transportation, are at once optimistic and sober. The technical problems are analyzed in simple terms together with the possibilities of

Only in the chapters on air-age education and on aerial policing do the authors' convictions appear to play the leading part. On education, in particular, they write as passionate advocates of a realignment of the whole educational system around aeronautical requirements, interests and incentives. "The Coming Air Age" finds in aviation a new, dominant influence—not only in physics and chemistry, to which "belongs the heavy responsibility of teaching why the basic rules of safe flying must be observed," but in English, where "the school children of the air age . . . will have new reasons (aeronautical ones) for wanting to be literate," and in history, where "it is not going to be easy to teach them their own inclination on the matter is to date human progress from the Wright brothers—an inclination to which most of their other subjects can cater gladly."

All this may exaggerate the violence of the break with the past. A country with 30,000,000 automobiles, and millions of trained machine operatives, has not had to await the airplane to find evidence of the universal influence of new applications of physical science to technology; but such whole-hearted advocacy of such far-reaching proposals, supported by so many detailed illustrations, deserves respectful reflection even by those who will be quick to object to its underlying assumptions.

CONCERNING the use of air power in the preservation of peace, Messrs. Neville and Cleveland show a laudable readiness to go beyond the generalizations with which that subject is too often disposed of, and to come to grips with the question of how

Also in NYPL
Group of clippings

inventing electric lamps and putting us on our electrical feet. Yet not much of Edison's apparatus is left. What we see about us is largely Tesla's. The man was a pioneer who could make a fortune and spend it all on lavish experimenting and who died owing J. P. Morgan, John Jacob Astor, Austin Corbin and others several millions. All were so many rabbits in the intellectual clutch of this fascinating boar constrictor. Newspaper reporters, though they could not understand what he was talking about, were enthralled with his proposals to transmit power without wires over vast distances. Tesla knew

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Though he lived to be 85, Tesla crowded most of his inventive activity within twenty years. And what activity it was! Polyphase current engineering, the induction motor, the use of oil in transformers, radio, electric arcs fed by direct current in a magnetic field, gas-discharge lamps which were forerunners of Broadway's neon lights, the medical application of high-frequency currents—the record speaks for itself.

As a practiced popularizer of science, Mr. O'Neill, who is the science editor of The New York Herald Tribune, vividly and skillfully tells the story of this extraordinary personality. His interest in his subject is more than that of the ordinary biographer. He wrote poems to Tesla as a boy, and when he made his acquaintance he sat enthralled therefore much of O'Neill in it, which is one of its chief charms. Because of this hero-worshipping attitude O'Neill gives Tesla far more than is his due. Tesla's great contribution to electrical engineering was his invention of alternating current machinery. Though O'Neill examines the claims of those who are regarded at least as independent inventors of this same machinery, especially of the claims of Prof. Galileo Ferraris, he seems to this reviewer much too enthusiastic in Tesla's behalf. Nothing is said of S. Z. Ferranti, who in his way was just as remarkable as Tesla and who

where they have been most specific. The continuity of the volume is scanty, for a variety of subjects is treated; successive chapters deal with matters ranging from the economics of private flying to the possible functioning of a world police force. All lie within the province of the title of the book; and some, at least, are the best concise treatments of their subjects that are so far available to the general reader. The chapters which will arouse the quickest interest, those dealing with air transportation, are at once optimistic and sober. The technical problems are analyzed in simple terms together with the possibilities of solution.

Those who let their hopes of air cargo run away with them—not so numerous now as in the vast air-cargo excitement of two years ago—are deflated by a reminder that to move all the existing railway freight traffic in the United States by air would require a volume of gasoline production of petroleum products. At the same time, the prospects of radical improvement in economy, both in fuel cost and in other costs, are recognized and discussed.

Highly successful, although somewhat more detailed than many lay readers will wish, is the chapter on air traffic control. The dependence of any large increase in air transportation upon the development of improved methods of handling the collision is very properly emphasized. Some of the specific possibilities of improvement are described.

The general approach is descriptive, with extended quotations from various authorities

find evidence of the universal influence of new applications of physical science to technology; but such whole-hearted advocacy of such far-reaching proposals, supported by so many detailed illustrations, deserves respectful reflection even by those who will be quick to object to its underlying assumptions.

CONCERNING the use of air power in the preservation of peace, Mearns Neville and Cleveland show a laudable readiness to go beyond the generalizations with which that subject is too often disposed of, and to come to grips with the question of how the "police force" would actually be used to meet specific emergencies. They accept it as probable that such a force will be created; they report the astonishingly exact conclusion that "the United States will be expected to contribute . . . 20,500 aircraft valued at \$2,785,400,000"; but they are not optimistic about the outcome. Weighing the pros and cons of such an organization in the scales of a commonsense historical memory, they see as all too easy the crumbling of the framework by the withdrawal of one or another of the great powers, for reasons of economy or mutual suspicion.

The portions of the book I have described fill the last three-quarters of its pages. The opening section is devoted to geography, with emphasis on the sphericity of the earth and the possibility of drawing misleading conclusions from maps based on the Mercator projection—issues which have been so heavily exploited in recent months as to have lost some of their freshness—and to a rather general discussion of some of the political problems of international air transport.



"Another of Tesla's ideas to render the production of cheap power is based on the utilization of the temperature difference between that of the ocean surface and that of the water three miles below the surface. The above sketch shows how the hot waters from the ocean depths are brought to contact with the considerably warmer waters of the upper levels, creating steam power to operate great turbines, which in turn drive generators." (Illustration and description from *Key Magazine*.)

(Continued on Page 22)

THE ylonian MUD



Edited
and
Translated
from the
original
Hebrew
by
JO AUBERBACH

Savings for the Poor
• Criminal Law
• Penalties
of the Sages

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anyone who desires
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The Life of an Uncompromising Humanitarian

AGAINST THE CURRENT. The Life
of Karl Heinzen. By Carl Wittke.
Chicago: University of Chicago
Press. 328 pp. \$5.75.

By GEORGE N. SHUSTER

AMERICA is, in part, the
handiwork of exiles. Nearly
a hundred years ago, after the
abortive revolution of 1848, the
first wave of political refugees
from Germany passed through
the formidable bottleneck of
Castle Garden. Many of them
were lovers of freedom, and some
served the major causes of the
time, particularly the Abolition-
ist movement. Perhaps the most
individualistic among them was
Karl Heinzen, for many years
editor of the vitriolic but uncon-
promisingly humanitarian *Pio-
nier*, memorable as one of the
landmarks of "radical" journal-
ism. Dean Wittke's biography of
this strange and able man is a
distinguished book, being scholar-
ly and objective as well as hu-
man and quite urbane.

Born in Dusseldorf while Na-
poleon was lord and master of
the Rhineland, Heinzen's mind
was fired by the ideals of the
French Revolution. He grew up
to be a most tempestuous re-
former, contemptuous on the one
hand of the religious and social
conventions to which his family
subscribed and vehemently hos-
tile on the other hand to the so-
cialistic Utopia advocated by
Marx and Lassalle. He held that
reason could solve life's problems
if only humanity gave it a
chance. The Germany he loved
must therefore clear the way for
the social application of reason
by becoming a republic of free
men. Naturally, it was often dif-
ficult to determine what "reason"
suggested in a given practical in-
stance. Heinzen quarreled with
his fellow-revolutionists of 1848,
finding for each of them an en-
dless variety of picturesque names.

tirely dedicated to lost causes and
forlorn hopes is shown by the fact
that Heinzen championed equal
rights for women and for Ne-
groes. He was, of course, also a
resolute foe of slavery. Since he
was a very well educated man,
his views on the subject of scho-
lastic training are still worth
reading, even though he was far
more Rousseauistic than Rous-
seau. His standards of morality
were exceedingly high, divorced
though they were from religious
belief and based upon a system
of thought which he termed "ma-
terialism." On the other hand,
he was the sort of radical who
vehemently insisted upon govern-
mental action for things he be-
lieved desirable, but resisted with
equal force all encroachments
into spheres he defined as per-
sonal. Thus he "advocated a
policy of punishment toward the
defeated South, but held that no
child ought to be compelled to go
to school. He demanded that the
State suppress the churches, but
advocated the public support of
temples in which the gospel ac-
cording to Heinzen should be
preached. Other immigrant
groups he was likely to refer to
with scornful contempt, while
holding that the right sort of
German was a precious Ameri-
can asset.

Possibly it is Heinzen's atti-
tude toward his native Germany
which is now of the greatest in-
terest. Until well past 1870 he
hoped that the republic of which
he had dreamed would be erected
and would embrace all the Ger-
man lands, including Austria. But
when his erstwhile countrymen
turned stuffy heagarts after the
defeat of France in 1870 and

docilely placed the Hohenzollerns
on the imperial throne, he fought
back with pamphlets, some of
which advocated "tyrannicide."
Slowly he was compelled to admit
that what he had hoped for
would never come to pass. He
wrote that German chauvinism
was more detestable than the
French variety, "because it is fed
by servility and insolence." Though
his language was usually
bizarre and extreme, much that
he had to say was prophetic.

Dean Wittke says quite mod-
estly that Heinzen deserves a
biography if only because he is
the evidence that "once there was
a strong, liberal, cosmopolitan
group in the German states which

is the absolute antithesis of pre-
sent-day nazism." The reader will
agree that the debt has here been
paid in worthy fashion. Yet the
suspicion will not vanish that one
reason why the "liberal, cosmo-
politan" German group did not
succeed must be found in its tur-
bulent, cantankerous individual-
ism—a trait which was, alas!
quite as marked in the era imme-
diately preceding Hitler as it was,
apparently, in 1848. Heinzen's
Communist friends referred to
him as a "bourgeois democrat." He
retaliated in kind. Just that
sort of debate was in progress
prior to 1932, and one can only
suppose that it will be resumed
anew as soon as peace returns.

Nikola Tesla, Electric Sorcerer

(Continued from Page 6)
certainly built in London the first
commercial alternating current
station.

O'Neill believes so devoutly in
Tesla that he regards him as the
father of electrotherapeutics.
Though D'Arsonval deserves fully
as much if not more credit for
the use of high-frequency cur-
rents in medical practice. There
is no doubt about Tesla's origi-
nality or about the grand way in
which he thought and acted, but
the phenomenon of simultaneous
and independent invention is so
well known that no physicist,
however accomplished, ever
stands alone.

Despite his extraordinary im-
agination, his profound knowl-
edge of science and his rare gifts,
Tesla remained a Victorian. When
the atomic physicist gave us the
electronic theory of matter and
Einstein relativity Tesla would

have none of them. He wanted
his infinite universe, his Euclid-
ian space, an ether which had
become preposterous even when
he was still in his prime. He
died, lonely and misunderstood,
leaving much of immense, prac-
tical importance but far more
which is no clearer to us than the
boasts of Paracelsus or the mys-
tical forebodings of a Nostrada-
mus.

O'Neill's book is the one full-
length biography and the one ap-
preciation of Tesla that we have.
An immense amount of work has
gone into its production. It does
honor both to Tesla and its au-
thor, and it ought to be read by
anyone who takes the slightest
interest in this highly electrified
world of ours. As for those nov-
elists who still believe that a
scientist is a wizard of the Mer-
lin type, they will find O'Neill's
Tesla made to order.

C.S.

2,000 ARE PRESENT AT TESLA FUNERAL

Cathedral of St. John the Divine
Is Scene of Yugoslav State
Function for Scientist

GREAT IN SCIENCE ATTEND

Ambassador Fotitch Heads the
Procession of Mourners—
Bishop Manning Assists

Inventors, Nobel Prize winners, leaders in the electrical arts, high officials of the Yugoslav Government and of New York, and men and women who attained distinction in many other fields paid tribute yesterday to Nikola Tesla, father of radio and of modern electrical generation and transmission systems, at an impressive funeral service in the Cathedral of St. John the Divine.

The service, conducted in Serbian by prominent priests of the Serbian Orthodox Church, was opened and closed by Bishop William T. Manning, assisted by Father Edward West, Sacrist of the Cathedral. The Serbian Orthodox Office for the Dead was said by the Very Rev. Dushan Shoukletovich, rector of the Serb Orthodox Church of St. Sava, who officiated in the name of the Serbian Orthodox Church in America.

City Is Represented

More than 2,000 persons attended the service. The city was represented by Newbold Morris, President of the City Council, who headed the list of honorary pallbearers. Other honorary pallbearers included Dr. Ernest F. W. Alexanderson of the General Electric Company, inventor of the Alexanderson alternator; Professor Edwin H. Armstrong of Columbia University, inventor of frequency modulation and many other important radio devices; Dr. Harvey C. Rentschler, director of the research laboratories, Westinghouse Electric and Manufacturing Company; Gano Dunn, president of the J. G. White Engineering Corporation; Colonel Henry Breckenridge, Dr. Branko Cubrilovich, Yugoslav Minister of Agriculture and Supply; Consul General D. M. Stanoyevitch of Yugoslavia and Professor William H. Barton, curator, Hayden Planetarium.

Fotitch Heads Procession

The funeral service was held as an official State function of the Yugoslav Government, which was officially represented by Constan-

tine Fotitch, Yugoslav Ambassador to the United States. Dr. Fotitch led the procession of mourners who passed the coffin before it was closed. Oscar Gavrilovich, Yugoslav consul in New York, headed the list of ushers.

Many telegrams were received from officials of the United States Government, prominent scientists, literary men and many others. These included messages from Mrs. Roosevelt, on behalf of herself and the President; Vice President Henry A. Wallace, Professors Robert A. Millikan, Arthur H. Compton and James Franck, all Nobel Prize winners in physics; Professor William Lyon Phelps of Yale, Jean Piccard and Major Gen. J. O. Mauborgne, U.S.A., retired.

Mrs. Roosevelt's message read: "The President and I are deeply sorry to hear of the death of Mr. Nikola Tesla. We are grateful for his contribution to science and industry and to this country."

Vice President Wallace's message read as follows:

"Nikola Tesla, Yugoslav born, so lived his life as to make it an outstanding sample of that power which makes the United States not merely an English-speaking nation but a nation with universal appeal. In Nikola Tesla's death the common man loses one of his best friends."

Scientists Pay Tribute

Drs. Millikan, Compton and Franck paid tribute to Tesla as one of the world's outstanding intellects, who paved the way for many of the important technological developments in modern times.

Among the many floral offerings was a wreath from King Peter II of Yugoslavia; the Royal Yugoslav Government, Ambassador Fotitch and many Yugoslav societies.

Chief mourner was Sava Kosanovich, nephew of Dr. Tesla and president of the Eastern and Central European Planning Board, representing Yugoslavia, Czechoslovakia, Poland and Greece.

The body was taken to Ferncliffe Cemetery, Ardsley, N. Y., where it will be in the receiving vault until plans are completed.

CAPT. EDWARD B. WINN

SAN JUAN, Puerto Rico, Jan. 12 (AP)—Captain Edward B. Winn, United States Army Finance Officer at the San Juan departmental headquarters, died yesterday at the age of 52.

Other obituaries on preceding page.

French
NEW CLASSES TODAY

FRENCH — Wednesday, 6 to 8 p. m.
SPANISH — Wednesday, 7 to 9 p. m.
ITALIAN — Wed. & Fri., 8 p. m.

BERLITZ SCHOOL OF LANGUAGES

Rockefeller Center (at 50th St.)
Same classes in Brooklyn, 66 Court St.



EDGAR PALMER

NIKOLA TESLA RITES TO BE HELD TUESDAY

Yugoslav Government - in - Exile Plans Official State Funeral

Nikola Tesla, father of radio and of the modern electrical transmission systems, who died Thursday night at the Hotel New Yorker at the age of 86, will receive an official state funeral under the auspices of the Yugoslav Government-in-Exile, it was announced last night by the Yugoslav Information Center.

The service will be held in the Cathedral of St. John the Divine on Tuesday at 4 P. M. Meanwhile the body will lie in state at the Campbell Funeral Church, Madison Avenue and Eighty-first Street.

Yugoslavia, where Dr. Tesla was born of Serbian parents, will be officially represented by Ambassador Constantin Fotitch and many present and former high officials of that country. Among them will be Dr. Ivan Shubashlich, Governor of Croatia; Dr. Bogoljub Jevtich, former Prime Minister of Yugoslavia; Branko Chubrilovich, Yugoslav Minister of Food Supply and Reconstruction; Franc Snoj, Minister of State representing the Slovenes, and Dr. Tesla's nephew, Sava Kosanovitch, president of the Eastern and Central European Planning Board, representing the Yugoslav, Czechoslovak, Polish and Greek Governments.

Held Patents on Transformers

Dr. Tesla, who held more than 700 basic patents, is regarded as the man who laid the foundations for modern radio broadcasting and television; for the giant electrical transformers and other transmission apparatus, and for the basic apparatus that makes possible neon lights and fluorescent illumination.

To the end of his days Dr. Tesla claimed that the Marconi system of wireless telegraphy was an infringement on his method and apparatus for transmitting energy without wires. Dr. Tesla brought suit against Marconi in an effort to gain legal recognition of his claim. He blamed his failure to establish his patent rights to the paucity of technical knowledge at that time on the difference between microwaves and short waves. When the distinction finally became clear the original Tesla patents had run out.

ANDER

WORLD

1-8-43

World War

36

Nikola Tesla Dies At 85 Alone in His Hotel Suite

Celebrated Inventor,
Born in Yugoslavia,
An Electrical Wizard

Nikola Tesla, 85, inventor of the Tesla coil, the induction motor and hundreds of other electrical devices, died last night in his suite at the Hotel New Yorker. According to hotel officials, he had been in failing health for two years.

The world-famous inventor, who died alone, was found dead in bed by a maid. She called a hotel physician.

The hotel management started a search for friends or relatives. It was believed a nephew is living in the city but his whereabouts are not known.

Nikola Tesla was born in Smiljan, Yugoslavia, in July, 1859. His father, a Greek Orthodox Church minister, was a noted writer, orator, linguist and mathematician. His mother, Georgina Mandic, was an inventor.

Came Here in 1894.

Tesla studied at Graz Polytechnic Institute and the University of Prague after preparatory work at the Realschule of Lika and Carlstadt. He came to the United States in 1894, and became a naturalized citizen.

In 1886 he designed the arc-lighting system. Two years later he invented the Tesla motor and designed a plan for the transmission of alternating current. The following year he presented plans for electrical conversion and distribution by oscillatory discharges.

His high frequency studies and development of the transforming coil bearing his name occurred from 1890 to 1891. From then up to 1900 his discoveries and inventions included such fields and appliances as wireless communication, electrical oscillation, radiant power and radioactive matter.

Communications and wireless power transmission occupied most of his research after that. He worked at the laboratories of Thomas Edison at Orange, N. J., specializing in motor design.

Fed Crumbs to Pigeons.

During recent years Mr. Tesla had been seen, but seldom recognized, on the steps of St. Patrick's Cathedral, in front of the Public Library and in Greeley St., invariably carrying a bag of crumbs which he fed to the pigeons.

Mr. Tesla's only military invention was a method to which he once alluded but never fully described. It was a means whereby an impenetrable "wall of force" could be erected about a nation's borders which would render helpless any military attack. He disclosed existence of the plan in 1934, and said he intended to present it to the Geneva Conference. He seldom referred to it afterward.

In 1936, when he was 80, he said his original plan to live to be 135 had been changed with the repeal of prohibition, and he would live to be 160 instead.

He was decorated by the Yugoslav and Czech governments. He wept when he met King Peter of Yugoslavia here last July.

65-1700

JAN. 8, 1943

THE NEW YORK TIMES, 1

NIKOLA TESLA, 86,
PROLIFIC INVENTOR

Alternating Power Current's
Discoverer Dies in His
Hotel Suite Here

HIS 'DEATH BEAM' CLAIM

He Insisted the Invention
Could Annihilate an Army
of 1,000,000 at Once

Nikola Tesla, electrical inventor,
died last night in his suite at the
Hotel New Yorker.

According to the hotel staff, the
electrical engineer and designer,
who was 86 years old, had been in
failing health for two years. Of
vigorous temperament and with
emphatic ideas on personal health
as well as engineering, he had few
visitors, according to the hotel
management, which reported that
his meals, strictly vegetarian-style,
were especially prepared for him
by the chef.

"He made everybody keep at a
distance greater than three feet,"
a hotel executive recalled.

A spokesman for the hotel said
that Dr. Tesla died as he had spent
the last years of his life—alone.
He was found dead in bed by a
floor maid at 10:45 P. M. She
called a house physician, who pro-
nounced him dead.

The New Yorker management
was attempting last night to locate
friends of the inventor. It was be-
lieved he had a nephew living in
this city.

Ideas Fantastic Toward End
Nikola Tesla's ideas bordered in-
creasingly on the fantastic as he ad-
vanced in years. On his seventy-
eighth birthday he announced in an
interview that he had invented a
"death beam" powerful enough to
destroy 10,000 airplanes at a dis-
tance of 250 miles and annihilate
an army of 1,000,000 soldiers instan-
taneously.

In his seventy-seventh birthday
interview he had no specific inven-
tion, but said he expected to live
"beyond 192." The year before,
however, he spoke of two great in-
pending discoveries.
"When they are announced," he
said, "one will be like the 100,000
trumpets of the Apocalypse. The
other will be less sensational, but it,
too, will be important. It will be
like the shout with which Joshua's
army brought down the walls of
Jericho."

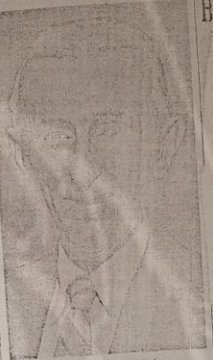
Since he made his first practical
invention—a telephone repeater—in
1881, while living in Budapest, Mr.
Tesla claimed to have made about
700. Many of them were of great
importance, but these were nearly
all invented in the last twenty
years of the past century.

Not Practical in Business.

He was greatly handicapped by
lack of funds, for he was anything
but a practical man as far as
business was concerned. It was
said that he was frequently victim-
ized, but he did not seem to worry
much as long as he had a place to
work.

Tesla probably could have become
a rich man had he chosen to be-
come an employee of a large indus-
trial concern, but he preferred po-
verty and freedom. Early in 1887
he had formed the Tesla Electric
Company of New York, but the
little concern was not a financial suc-
cess. For many years he did not
even have a laboratory to work in,
conducting his experiments in hotel
rooms.

Of his inventions the most im-
portant were his systems of alter-
nating current power transmission



NIKOLA TESLA
The New York Times, 1925

charges was devised the following
year, and in 1891 the now famous
Tesla coil, or transformer, was in-
vented.

Mr. Tesla devised a system of
wireless transmission of intelligence
in 1893, and this was followed by
mechanical oscillators and genera-
tors of electrical oscillations.

From 1896 to 1898 Tesla made ra-
dio searches and discoveries in radia-
tion, material streams and emana-
tions.

Mr. Tesla received the Elliot
Cresson gold medal in 1903 in recog-
nition of his original work. He
presented before the Franklin In-
stitute and the National Electric
Light Association.

In November, 1931, he publish-
ed designs of two power plants, one
utilize the heat below the surfa-
ce of the earth, the other to take
advantage of the difference between
the upper and lower levels of the
ocean.

Preferred Sleep to Society.

Shy of manner and ascetic in
tastes, Mr. Tesla preferred
solitude to society. He ne-
ver married. He ate sparingly,
drank neither coffee nor tea
because he considered those in-
jurious. On the other hand, he regarded alcohol
moderation as virtually an in-
alienable part of his life. It was his habit to use
until dawn, and then sleep
for a few hours before resu-
ming his work.

At one time Tesla had the
idea of building a tall
tower on Long Island to ser-
vice wireless power, but when his
er died no more money was
coming and the plan had
abandoned.

Mr. Tesla once owned a ho-
tel on Houston Street, New
York, but it burned down and he
had another.

CAPTAIN A. C. KROE

Ex-Officer of Netherlands
—Was Released by Japan

MEIBERG, E. Australia, J.
(Netherlands) News Agent
Captain A. C. Kroef, former
moderate in R. P. M., Royal Ne-
lands Steam Packet Company,
Eastern shipping line, who
turned to Melbourne recently
his release from a Japanese in-
ment camp, died yesterday
heart attack.

Captain Kroef first knew of
state of war existed between J.
and the Netherlands when his
was seized and he and his fa-
mily were jailed in Yokohama.
After twenty-one days of li-
beral "filthy conditions" he
transferred to an internment ca-
mp where conditions were "some-
what better."

He stayed with K. P. M.
thirty-three years, twenty-five
which were spent on the Singa-
pore, Netherlands East Indies-Aust-
ralia.

W.A. Brown, Jr.
1752 481

Articles - 1900

18 but a practical man as far as business was concerned. It was said that he was frequently victimized, but he did not seem to worry much as long as he had a place to work.

19 Tesla probably could have become a rich man had he chosen to become an employe of a large industrial concern, but he preferred poverty and freedom. Early in 1887 he had formed the Tesla Electric Company of New York, but the concern was not a financial success. For many years he did not even have a laboratory to work in, conducting his experiments in hotel rooms.

20 Of his inventions the most important were his systems of alternating current power transmission and distribution of electrical energy. His system of electrical conversion and distribution by oscillatory discharges was highly significant, as were his researches and discoveries in radiations, material streams and emanations.

21 After his discovery of a system of transmission of power without wires and a high-potential magnifying transmitter. Tesla had been chiefly engaged—since 1903—in the development of a system of telegraphy and telephony, and designing a plant for the transmission of power without wires, to be erected at Niagara.

22 As early as 1904 Tesla made it known that he was experimenting with interplanetary communication. He firmly believed that most of the planets are inhabited and that messages could be sent between the earth and Mars, Jupiter, Venus, &c.

23 He also had visions of harnessing the sun's rays and of utilizing the energy of the sea.

Son of Greek Clergyman.

24 Nikola Tesla was born at Smiljan, Lika, a border country of Austria-Hungary, on July 10, 1856. His father was a Greek clergyman and orator, and his mother, Georgina Mandic, was an inventor.

25 His education began with one year in elementary school and then four years of the lower Realschule at Gospić, Lika. Then he went to a higher school at Carlsstadt, Croatia, being graduated in 1873. He studied for four years at the Polytechnic School at Graz, devoting most of his time to mathematics, physics and mechanics, and then had two years at the University of Prague, where he studied philosophy.

26 In 1881 he went to Paris, where he worked as an electrical engineer, and the following year he went to Strasbourg, where he installed a mechanical plant. He was attracted to America by the remarkable progress in electrical energy, and came to this country in 1884.

27 For some time he worked with Thomas A. Edison at Orange, N. J., chiefly designing motors and generators. In a short while a proposal was made to him to start his own company. He accepted the terms and began by working up a practical system of arc lighting, as well as a potential method of dynamo regulation, which became known as the "third-brush regulation."

Invented Coil in 1891.

28 He also devised a thermomagnetic motor and other kindred devices. Soon after the Tesla Electric Company had been formed Mr. Tesla produced his epoch-making motors for alternating current, in which, going back to earlier ideas, he evolved machines having neither commutator nor brushes. This important invention came in 1888. His system of electrical conversion and distribution by oscillatory dis-

tributed Steam Packet Company, Eastern shipping line, who turned to Melbourne recently, his release from a Japanese internment camp, died yesterday heart attack.

29 Captain Kroeef first knew if state of war existed between Japan and the Netherlands when his was seized and he and his four officers were jailed in Yokohama. After twenty-one days of life under "filthy conditions," he transferred to an internment camp where conditions were "somewhat better."

30 He served with K. P. M. thirty-three years, twenty-five of which were spent on the Singaj Netherlands East Indies-Australia run. Captain Kroeef was in retirement in Sydney when the European war broke out, and re-ent maritime service after the invasion of the Netherlands in 1940. son, Jan, is serving with the Netherlands Navy.

MOHAMMED HASSAN

31 Persian Prince of Former R House Dies in Exile at 4

32 Special Cable to The New York Times LONDON, Jan. 5.—Prince Mohammed Hassan of Persia, brother of the former Shah, Sultan Ali, and member of the Kadjar dynasty, collapsed in the street at Madrid today, dying while taken to a hospital. His age was 40.

33 The Prince, who proclaimed right to the throne in 1930, had Persia after the Riza Khan of 1925, and had lived in England since. Surviving are two sons, one of whom is in the British Army.

ERNEST J. HOWE

34 Special to The New York Times Poughkeepsie, N. Y., Jan. 5.—Ernest J. Howe, an assistant civil engineer of the New State Department of Public Works assigned to the Poughkeepsie office, died today in the Veterans Hospital here at the age of 66.

35 Mr. Howe, who was born in Canton, Mass., and was graduated from the University of Maine, a former chief engineer of Taconic State Park Commission. He entered the employ of the New York State Department of Engineers in 1906.

36 He leaves a widow, Mrs. Amy Howe.

SAMUEL W. TILDEN

37 MONTREAL, Jan. 7 (Canada Press)—Samuel W. Tilden, who formerly was well known as an amateur boxer and basketball player in the United States and Montreal and was manager here for an Ottawa printing and lithographing firm, died yesterday at his home in neighboring Westmount at the age of 70. He was born in Westport, Mass., and came to Montreal in 1904 as manager of Mortimer Ltd., Ottawa printers. He leaves a widow.

the Spirit.—Ephesians, V., 18.

gested by Rev. J. A. Villelli, pastor of Sea and Land Presbyterian Church, Manhattan.)

HUMAN SIDE OF THE NEWS

By Edwin C. Hill

A Magician in Science.

TO the moon with America's greatest living inventor, Nikola Tesla! Well, not precisely—though if Father Time were to grant Mr. Tesla another half century or so of life I, for one, wouldn't bet against the moon adventure under his eager auspices. The man has lived long and wrought greatly, and the keenest desire of his life is to live longer and materialize the dreams which haunt his scientist's imagination.

He is working now on an energy-transmitting device to project electrical waves to Lady Luna, waves of such potency and power that a tract of light as large, perhaps, as the State of Connecticut could be fixed momentarily upon the surface of the moon. If he lives long enough he will do it, and that's a fairly safe prediction, for Dr. Tesla has accomplished many marvels in his 82 years upon this earth.

His birthday falls on July 10, and finds him in fair health for one of his years.

It was 46 years ago, B. M., Before Marconi, that Nikola Tesla predicted the coming of radio communication and sent electrical waves racing around the globe from high voltage generators.

Another dream of this truly great scientist is to perfect what we laymen might call a "magic ray" which would protect ships from the mariner's greatest peril, fog, and bring them unflinchingly to port. It might indeed—so far does his dream range out over the troubled field of human life—put an end to war. A magic ray so terrible, so powerful that raiding airplanes could not last one second above their designed victim of a city.

Mr. Tesla lives and dreams and works at a New York hotel and there, usually, you may find him upon any proper business—amiable, charm-



EDWIN C. HILL

ingly conversational, intensely interesting with his glimpses of new marvels and promises of a new world. He is the only American inventor with 750 basic patents to his credit—the only inventor who ever lived, so far as this writer knows, who ever explored so many fields with patented results to prove his roving and wanderings. Half the civilized nations of the world have honored him with orders and medals.

Nikola Tesla is an Austrian. He was only 28 years old when he came from the University of Prague to enter the laboratory of the great Edison. That was the beginning of an amazing career. For more than 50 years he has been a man of magic. Full-fledged from his amazing brain have come marvel after marvel. He gave us the induction motor which made possible alternating electric current. He gave us innumerable indispensable electrical appliances. His imaginative mentality reaches out into the hereafter itself. He wonders if life cannot be recalled—as to whether a man electrocuted in the death chair could be restored to life by the application of an electrical current. He really thinks it could be done.

It was 30 years ago, on Pike's Peak, that he is sure he plucked from the air at that 14,000 foot height signals from the planet Mars. Mr. Tesla believes, as the late Prof. Lawrence Lowell believed, that there are living, humanlike creatures on our nearest neighbor in the family of planets, and much more intelligently advanced than we are. He thinks that they have been trying for many centuries to reach our dull intelligences.

Now, at 82, Nikola Tesla is working not only on an apparatus to prove unfailing communication, to insure safety of ships, to locate hidden treasure and to determine the earth's physical constants, but also on a means to end war. Mr. Tesla is reaching into the infinite to snatch a bolt of lightning for the salvation of mankind. It is to be the Tesla death beam—literally a lightning bolt. It will have such a terrific energy that a thousand invading airplanes could be sent earthward in flaming fragments within ten heartbeats—annihilated. Two hundred thousand men, horse, foot and artillery, crossing the border of a defeated enemy could be dropped dead in their tracks.

MARCH OF EVENTS

By Benjamin DeCasse

articles - 170

TESLA'S EARTHQUAKE

Mr. Weyant, Editor, Scientist's
Test in the Year 1898.

To the What Do You Think Editor:
First Answering the query of
"One Who Was There" in your
issue of the twenty-second, re the
demonstration by Nikola Tesla: In
my extensive files re Houston street
I find an item of July 11, 1935,
from the Brooklyn Times Union,
entitled "Scientist Tesla Reveals
Self as Earthquake-Maker: Started
Houston Street Tremblers 37 Years
Ago; Could Shake Down Whole
City." It is too long to quote, but
the date is probably what concerns
for Inquirer, so, 1898 would be the
date when Tesla started the Hous-
ton street earthquake, and probably
he had occupied his laboratory for
years before that. And The New
York Sun of July 11, 1935, carried
three pictures of Tesla.

MORRISON V. R. WEYANT.

MAN'S GREATEST ACHIEVEMENT

By Nikola Tesla.

Man is born its sense-organs are brought in contact with the outer
world of sound, heat and light, beat upon its feeble body, its sensitive
nerves, the muscles contract and relax in obedience: a gasp, a breath,
a marvelous little engine, of inconceivable delicacy and complexity
unlike any on earth, is hitched to the wheelwork of the Universe.
The little engine labors and grows, performs more and more involved operations, be-
comes sensitive to ever subtler influences and now, there manifests itself in the
fully developed being - Man - a desire mysterious, inscrutable and irresistible: to
imitate nature, to create, to work himself the wonders he perceives. Inspired to
this task he searches, discovers and invents, designs and constructs, and covers with
monuments of beauty, grandeur and art the star of his birth. He descends into the
bowels of the globe to bring forth its hidden treasures and to unlock its immense
imprisoned energies for his use. He explores the dark depths of the ocean and the
azure regions of the sky. He peers into the innermost nooks and recesses of
molecular structure and lays bare to his eyes worlds infinitely remote. He subdues
and puts to his service the fierce, devastating spark of Prometheus, the titanic
forces of the waterfall, the wind and the tide. He tames the thundering bolt of
Jove and annihilates time and space. He makes the great Sun itself his obedient
toiling slave. Such is his power and might that the heavens reverberate and the whole
earth trembles by the mere sound of his voice.

What has the future in store for this strange being, born of a breath, of per-
ishable tissue, yet immortal, with his powers fearful and divine? What magic will
be wrought by him in the end? What is to be his greatest deed, his crowning achieve-

TESLA HAS PLAN TO SIGNAL MARS

Scientist, 81 Years Old,
Celebrates Birthday.

DECORATED BY 2 COUNTRIES

Seeks Guzman Prize for Idea on
Planet Communication.

Nikola Tesla is 81 years old. Some reference books, including "Who's Who," fix the year of his birth at 1857. He does not know whether the anniversary should have been celebrated Friday or, as it was, on Saturday, because it was just at midnight between July 9 and July 10 that he was born. But the year was 1856.

It was a most unusual birthday party the inventor held at the Hotel New Yorker, where he makes his residence. For the Ministers of his native Yugoslavia and neighboring Czechoslovakia and their staffs, Dr. Tesla had provided a most unusual material and mental feast.

Figuratively, at least, they are still smacking their lips today over the food and wines and speculating about what may come from the discoveries the scientist announced his quest for the French Academy prize for interplanetary communication, the perfection of a tube to carry immense electrical voltages, and some of the more abstract observations regarding cosmic rays and what makes this universe of ours expand and contract, oscillating instead of always expanding as some physicists hold.

Considering his years and the fact that recently he was the victim of an automobile accident which shook his system seriously, Dr. Tesla is exceedingly vigorous. His thinning hair, although predominantly white, still has considerable black. His eyes are as keen and penetrating as ever. He speaks distinctly although, of course, was a bit of the accent he has always had. But he picked up questions quickly and answered them in a manner that showed a tremendous grasp of all the latest theories of the astronomers, physicists and other scientists.

Announces Discoveries.

In recent years Dr. Tesla has made a habit of announcing on his birthdays some of the discoveries he has made in the past year. And he feels that with the passing of the years they have increased in importance. He said: "The maximum power of man is reached in his age rather than in his prime, as many suppose. Every one should have a decade to sum up the work of his lifetimes after he reaches the age of seventy-five. By then, if he has worked constantly in one field, he has gained so much experience that the solution of problems becomes much easier."

Everything at the birthday party was designed to lead up to the discussion of the inventor's latest achievements. Although he tasted only two of the courses and refrained altogether from any drink but water, he treated his guests to the finest in foods and wines.

The piece de resistance was "Cassard en casserole a la Tesla," a dish he had planned himself about ten years ago, consisting of duck roasted slowly in a casserole, smothered with whole stalks of celery. It won unstinted praise from the diplomatic representatives.

Dr. Tesla did take just a taste of this dish to make certain that it had been properly prepared and, as a sign of his approval had the chef come in to receive the applause of

He gave little glimpses of his boyhood life in Yugoslavia. One gentleman he had acquired much of his Slavonic priest, and his mother, a practical and also a brilliant woman. When, in 1884, Dr. Tesla landed at the Battery he had just 4 cents. He had only gone a few blocks up Broadway when he saw some men that had broken down.

"It was a machine I had helped to design, but I did not tell them that," I asked. "What is the matter?" and they said, "This thing won't work." I asked, "What would you give me if I fix it?" "Twenty dollars," was the reply. I took off my coat and went to work. I had it running perfectly in an hour and had earned \$20."

He shortly found it was not all as easy as that. There were many days when he did not know where the next meal was coming from. But I was never afraid to work. I went to where some men were digging a ditch. I said I wanted to work. The boss looked at my good clothes and white hands and he laughed to the others. "This man wants to work." But he said "All right. Split on your hands. Get in the ditch. Go to work." I worked harder than anybody. At the end of that day I had \$2. And I kept it up until I had enough to get started again."

Support Bums Today.

"Could that happen today?" he was asked. There was a serious pause, a grave frown and he said, "I am afraid not. The present is destructive. The workers are expected to support the bums."

Before the birthday cake was cut Dr. Tesla was invested with the Czechoslovakian ministers had brought. Dr. Constantine Folitch, tended by R. Petrovich, first secretary of his legation, and R. P. Stoyanovich, the Consul-General here, bestowed the grand Cordon of the White Eagle in behalf of King Peter.

Dr. Tesla sharply recalled those physicists who contend that cosmic rays originate in far places of the universe where matter is converted into energy. He produced a formula saying "The kinetic and potential energy of a body is the result of motion and determined by the product of its mass and the square of its velocity. Let the mass be reduced, the energy is diminished by the same proportion. If it be reduced to zero, the energy is likewise zero for any finite velocity."

About half of his talk was devoted to abstract scientific problems.

Turning from the more metaphysical aspects of his studies to the practical, Dr. Tesla disclosed his greatest ambition is to be the man who evolved a method of communicating with other planets. He thinks he has found the answer and is preparing to lay its formulae before the Institute of France in quest of the Pierre Guzman prize of 100,000 francs offered for a means of communicating with other worlds.

The man who accomplishes this, he feels, will be remembered after all present inventions are forgotten.

Streamlined Train Takes Elks to Denver

DENVER, July 12 (A. P.).—The Denver Rocket, a Rock Island streamlined train, concluded its maiden trip at 11:35 P. M. yesterday, bringing a delegation of Chicago Elks to the national convention here.

The train, an 1,800-horse power motor pulling three cars, left Chicago at 7 A. M., making the trip in 16 hours and 35 minutes.

NOVEL

N.Y. SUN
JULY 12, 1937

N.Y.
Sun
July 12, 1937

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Dr. Tesla did take just a taste of this dish to make certain that it had been properly prepared and, as a sign of his approval had the chef come in to receive the applause of his guests. The other dish of which he partook was a felled consommé. Alcohol, he believes, is a great thing. Whisky and wine are preferable to coffee and tea. As his guests smacked their lips over some of the vintages he had brought forth for the occasion, they were disposed to agree with Dr. Tesla on this point.

Genius From Parents

It was in the random conversation of the meal that one learned many intimate things about Dr. Tesla.

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Support Bums Today

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Before the birthday cake was cut Dr. Tesla was invested with the orders which Yugoslavian and Czechoslovakian ministers had brought. Dr. Constantine Fotitch, Yugoslavian Minister, who was attended by R. Petrovich, first secretary of his legation, and B. P. Stoyanovich, the Consul-General here, bestowed the grand Cordon of the White Eagle in behalf of King Peter.

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Chicago Daily News
July 15, 1935

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Tel. Dearborn 1111

THE CHICAGO DAILY NEWS, INC.
FRANK KNOX
Editor and Publisher

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days the commutator, which made it possible for the dynamo to deliver direct current, was not only necessary, but had become a sacred technical cow. Without it there could be no direct current from the dynamo, and science knew not how to handle the other kind.

Tesla devoted years to knocking those commutators off the generator. To do that he had to develop an entirely new technology to make alternating current useful.

Did he succeed? Look about you!

PUZZLE

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STORIES IN STAMPS ELECTRIC WIZARD



SOME scientists scoff at him for his amazing theories, but Nikola Tesla has so heroic a record of achievement in electrical science that the world must take him seriously. Born July 11, 1856, in what is now Yugoslavia, this sharp-faced, wiry bachelor of 80 holds more than 700 basic patents, among which are the coils, motors, dynamos, condensers, and electric lamps which bear his name, the arc light, and many other electrical aids.

Tesla came to the United States when a youth. Here he discovered the principle of the rotary magnetic field, and since has been working on other ideas which seem so futuristic as to cause more conservative scientists to ridicule him. Yet, while he divulges his secrets of a proposed death ray, or a mysterious source of new power, or the photography of thought, he also scoffs at Einstein's theory of relativity and the general belief that the

sun is cooling off gradually.

Recently, on the occasion of Tesla's 80th birthday, Yugoslavia issued a set of four stamps picturing the scientist.

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practical

World Telegram & Sun, July 15, 1935

5, 1935

Tesla Predicts Ships Powered By Shore Beam

Seoffs at Normandie's Speed, Sees Success for His Plan to Use Stratosphere Ray

Would Light Sea at Night

Says French Liner's System Copies His in U. S. Boats

Dr. Nikola Tesla, scientist and seer whose discoveries in the fields of polyphase electrical current and wireless place him in the front rank of modern inventors, refused yesterday to be swayed by the record speed achievement of the French liner Normandie, crossing the Atlantic in 4 days 11 hours 42 minutes and predicted that enormous ships would cross the ocean at far greater speeds by means of a high-tension current projected as a sea through the upper reaches of the atmosphere.

In his room at the Hotel New Yorker, dressed in a blue bathrobe, blue socks and red slippers, Dr. Tesla expounded the principles of his fabulous method of power transmission—a method which he has been developing at irregular intervals from so far back as 1887. The virtues of stratosphere transmission, he said, lay not only in its potential increase of speed but also in its power to eliminate the dangers of nocturnal navigation.

In short, high-tension currents of electricity passing through the stratosphere would light the sky and to a power plant stationed at intermediate points such as upon the Azores and Bermuda, would be able to cross the Atlantic by electricity generated at shore. These would no longer be subject to danger of boiler explosions nor hazards of collision at sea. Even on moonless, cloudy nights, there still would gleam overhead the faint rays of auroral electrical currents, so strong that pilots would be able to distinguish objects miles away.

Normandie Uses U. S. Cruiser System

Dr. Tesla, a tall, slender man with straight silvery hair, lean features and bright blue eyes that belie his seventy-eight years, prefaced his prophecies by pointing out that the Normandie's system of power generation and application was not new, but one which had been adopted long ago in some of the United States cruisers. The principle is one of his own invention.

"The Normandie," he said, "employs an 'electric drive' in which turbines drive generators and generators supply the current to independent motors. In this case the turbines are driven by steam, the generators are of the three-phase type and the motors are of the induction type."

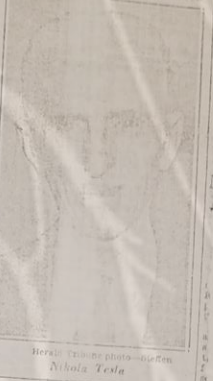
"In many respects the machinery installed on the United States cruisers by former Secretary Josephus Daniels is more remarkable than that on the Normandie on account of the limitations of available space. Moreover, while the Normandie develops only 150,000 horsepower, the cruisers each develop 165,000 horsepower. These cruisers employ the most remarkable engine plants in the world, and I believe that this drive would not have been employed on the Normandie had it not been for the planning work done in the United States."

"In view of the adoption on such a large scale of these inventions of mine, it is interesting to recall that I was violently attacked only a few years ago by a professor of marine engineering at Columbia, who claimed the electrical drive was not feasible and that it was folly to undertake it. "However splendid the machinery on the Normandie might be, the time is not distant when we will have much simpler and better means of propulsion."

Cites His Force Beam as One Way

Here Dr. Tesla recalled the possibilities of his force beam of particles which he announced last year as a potential far-reaching weapon of great value. One of its aspects is a death ray capable of destroying airplanes and ships. Another is a means of power transmission which could be used to project immense voltages of power over a distance limited only by

Not in Area of Normandie



Here is photo of Nikola Tesla

sity of vast outlays of capital and concerted harmonious endeavor of the chief nations of the world. The latter, he said, would be impossible to achieve at the present time. A third difficulty would be the task of keeping a ship at sea constantly in touch with a thrumlike beam of particles from ashore.

Dr. Tesla, therefore, suggested that his other scheme of stratosphere transmission of electricity would be a far more feasible means of marine propulsion. The principles of the two plans are entirely distinct. The force beam is a sort of barrage of tiny particles discharged at tremendous velocities from a kind of electrical gun. The other invention, which he has not hitherto discussed publicly, consists of transmitting high tension currents through the upper air, and receiving them by means of a vertical rod or beam which would be a sort of invisible electric pole. He discussed this yesterday.

Stratosphere Sea Idea in Port

"There is a notion of conveying great power to ships at sea which would be able to propel them across oceans at high speed. This method I conceived between 1897 and 1899, and in Colorado Springs in 1899 I made experiments along this line on a large scale."

"The principle is to use a ray of great ionizing power to give to the atmosphere great power of conduction. A high tension current of 15,000,000 to 20,000,000 volts is then passed along this ray to the upper strata of the air, which strata can be broken down very readily and will conduct electricity very well. "A ship would have to have equipment for producing a similar ionizing ray. The current which has passed through the stratosphere will strike this ray, travel down it and pass into the engines which propel the ship."

Pet Scheme to Light Ocean

"I will confess that I was disappointed when I made tests along this line on a large scale. They did not yield me the results I anticipated. At the time I used a current of 100,000 volts of ionizing power. As a source of ionizing power I employed a powerful ray of reflection from the time I saw a high tension ray of light from strata of the atmosphere. My scheme for stratosphere power is at present in the stage of development."

"However, I have made many improvements in my method which I know will be successful. A power plant, for instance, could be set up on the stratosphere, and the stratosphere sky sufficient to project a beam of objects upon the earth at a distance."

Dr. Tesla said that he was working constantly day to day to perfect his force beam. He said that stratosphere transmission of power, and a number of other inventions, the nature of which he was not ready to disclose.

Powder Near Tucson Home

11 Boxes of Explosives Found Near Philip's Home

MANHATTAN, N. Y., June 5 (AP)—Eleven boxes of explosives were found today in a few yards from the home of Philip, a resident of Manhattan, N. Y., who is charged with the murder of a woman.

N.Y. HERALD TRIBUNE
JUNE 5, 1935

See this article varies slightly from the one in the group from NYPL

9,200 Visitors

More than 9,200 visitors were present at the opening of the new exhibit at the Science Museum, London, on Monday, June 1, 1920. The exhibit, which is the largest ever held in the museum, is a collection of objects of scientific interest, and is arranged in a series of galleries. The objects are of various kinds, including minerals, fossils, and specimens of plants and animals. The exhibit is open to the public from 10 o'clock in the morning until 5 o'clock in the afternoon, and is free of charge. The museum is situated in the Albert Museum building, which is one of the largest and most beautiful buildings in London. The exhibit is a most interesting and valuable one, and is well worth a visit to the museum.

How the Science Museum is One Way

The Science Museum is one of the most important institutions in the world, and it is one of the most interesting and valuable. The museum is a collection of objects of scientific interest, and is arranged in a series of galleries. The objects are of various kinds, including minerals, fossils, and specimens of plants and animals. The exhibit is open to the public from 10 o'clock in the morning until 5 o'clock in the afternoon, and is free of charge. The museum is situated in the Albert Museum building, which is one of the largest and most beautiful buildings in London. The exhibit is a most interesting and valuable one, and is well worth a visit to the museum.

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Human Side of the News

Nikola Tesla, 80-Year-Old Inventor, Explains His "Death Beam."

By Edwin C. Hill

THERE is only one man alive who has seven hundred basic patents to his credit. He is 79 years old. His name is Nikola Tesla and he promises us, on the thirtieth of this month, a machine ray which will supply humanity with a new means of safe and secure communication; a new and safe means of guiding ships; a dependable diving rod for locating the sunken and precious metal and other objects of the earth; and, fourthly, a means of revealing to science all of the earth's physical constants.



He is working on a means to end war. Mr. Tesla is reaching into the infinite to snatch a bolt of lightning for the salvation of the world, not the slaughter of mankind.

It will be, if and when perfected, the Tesla death beam—a lightning bolt, literally of millions of volts. It will be imbued with such horrid energy that a thousand airplanes, including the jet of an enemy would be annihilated, sent earthward in flames and flames within ten hours of the time.

Two hundred houses, including the foot and arm of the enemy, would be dropped in their tracks.

Dr. Tesla will tell you that he cannot help but believe that a weapon which will be so irresistible that war will become not only insane but ridiculous.

Submarine warfare, for example, would be impossible. Tesla's death beam materializes. One human being sitting in a glass tower at Montauk Point, L. I., let us say, could by the gentle pressure of a forefinger

on an ivory button, project hundreds of miles to sea and 200 feet below the surface, if necessary, a lightning bolt, which would destroy the undersea terror in a blinding flash.

Mr. Tesla, being a practical man and having little use for ever well-meaning, and knowing his fellowmen pretty well, has little faith in peace pacts and treaties. He is convinced that war can be ended only by making it too frightful for the human mind and body to endure.

"War," says Mr. Tesla, "must be converted into plain suicide. No nation, whatever the provocation, the greed or the ambition, will plunge into war if it knows positively that it is putting a gun to its temple or a knife to its heart."

Nikola Tesla is an Austrian. He was only 25 years old when he came from the University of Prague to enter the laboratory of the great Edison.

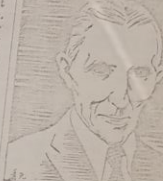
MAN OF MAGIC. Possibly the fiction (for fiction it was) that Mr. Edison needed little sleep and, in fact, took very little, sprang from the real truth that the terrifically ambitious and energetic young Tesla actually spent whole nights in the Edison laboratory, falling asleep only when sheer fatigue felled him; eating only when the weakness of famine came upon him.

That was his start. For more than fifty years he

has been a man of magic. Filled from his amazing brain have come marvel after marvel. It was Tesla who gave us the induction motor. It was that discovery which made possible alternating current and the transmission of light and power by that method.

It was Tesla who gave us innumerable indispensable electrical appliances—dynamoes, transformers, induction coils, oscillators and arc lamps.

In his later years he became fascinated with the possibilities of a transmission of power without wires. His imaginative mentality reached out not merely



into the future, but into the hereafter itself.

Mr. Tesla speculates seriously as to whether or not a man electrocuted in the death chair could be restored to life by the application of an electrical current. He believes, indeed, that the experiment might be successful.

SIGNALS FROM MARS.

It was thirty years ago, when he was conducting experiments at Pikes Peak, that he believes he picked from the air, at that 14,000-foot elevation, electrical signals from Mars.

Mr. Tesla believes, with the late Prof. Lowell, that there are living, human-like creatures on our nearest neighbor in the family of planets and that they are much more intellectually advanced than we are. He believes, indeed, that they have been trying for many centuries to reach our dull intelligences.

It would be a bold skeptic who could lightly discard the theories and predictions of the man who has worked such wonders, the man of fascinating mind who stands today as America's greatest inventor.

ONCE

SOME middle aged men who complain bitterly over not having received a square deal, dissipated the earnings of their younger years in having a good time.

They should remember that when tempted to gamble, some period in life must be dedicated to savings and self-discipline if an accumulation is ever to be made.

If not imposed voluntarily in younger years it will be required later.

It is a relief to hear certain old fellows say: "Well, I had a good time during the years when I was physically fit to enjoy it."

By Edgar A. Guest

Just Folks

Summer Cottage Creatures

What strange acquaintances I make Out at the cottage by the lake.

So many curious things I see, A different world it seems to be.

The rooms, the walls, the fields are rife With most fantastic forms of life:

Moth millers of a might size, Mysterious double-jointed flies;

Spiders and wasps and things that crawl Through window space and crannied wall;

Mosquitoes, gnats and stinging mites Buzz round the lamps on Summer nights,

Serving with ghastly frightfulness Some purpose which I cannot guess

Countless their number and their kind, And most ingeniously designed;

Strange shapes which seem to live and die, And wonder why.

Edgar A. Guest.

Now if these were promised to us by any other man than Nikola Tesla, the public smile and uplifted eyebrow might be in order, at the Edisons and Teslas of this world.

They have the goods. They have what it takes. This reporter fact just the other day when, with brethren and sisters of his craft, he greeted Mr. Tesla at a birthday luncheon in Mr. Tesla's New York home.

Ordinarily, the table chat of a distinguished scientist is not particularly entertaining. Indeed, it is apt to be quite over the head of his casual guest.

But Mr. Tesla has a vein of table talk which pans out much more to the point. He can make even Einstein intelligible.

In fact, he quite frankly kids around in the solar system, drives a route along the Milky Way and mixes Cosmic Rays with his breakfast food.

"COLLECTION OF ERRORS." In fact, one of the latest products of his brain will, he asserts, knock the Einstein theory of relativity for a double loop.

Quite picturesquely, Mr. Tesla describes relativity as "a beggar wrapped in purple whom ignorant people take for a king."

Relativity, indeed, is just plain bunk to Mr. Tesla.

"The whole business," he told this writer, "is a collection of errors and wild-eyed theories violently opposed to the sane teaching of real scientists, and truly hostile to plain common sense."

And the relativity theory takes all these errors and fallacies and clothes them in magnificent mathematical garb which fascinates and dazzles people and blinds them to the underlying errors.

I suppose that Mr. Tesla has a right to be included in a trio of the greatest American electrical scientists. Thomas A. Edison has passed

My Journal

Aug 10, 1935

The increase in the number of immigrants from the East and the increase in the number of immigrants from the West were more than 100,000 and 150,000 respectively. While the rare earths have little commercial importance, they obtained large quantities from the black sand which was the source of the intense white light emanating from it when it is heated on the surface of a mantle with thorium. This was a very rare element and was called "thorium" and was the source of the intense white light.

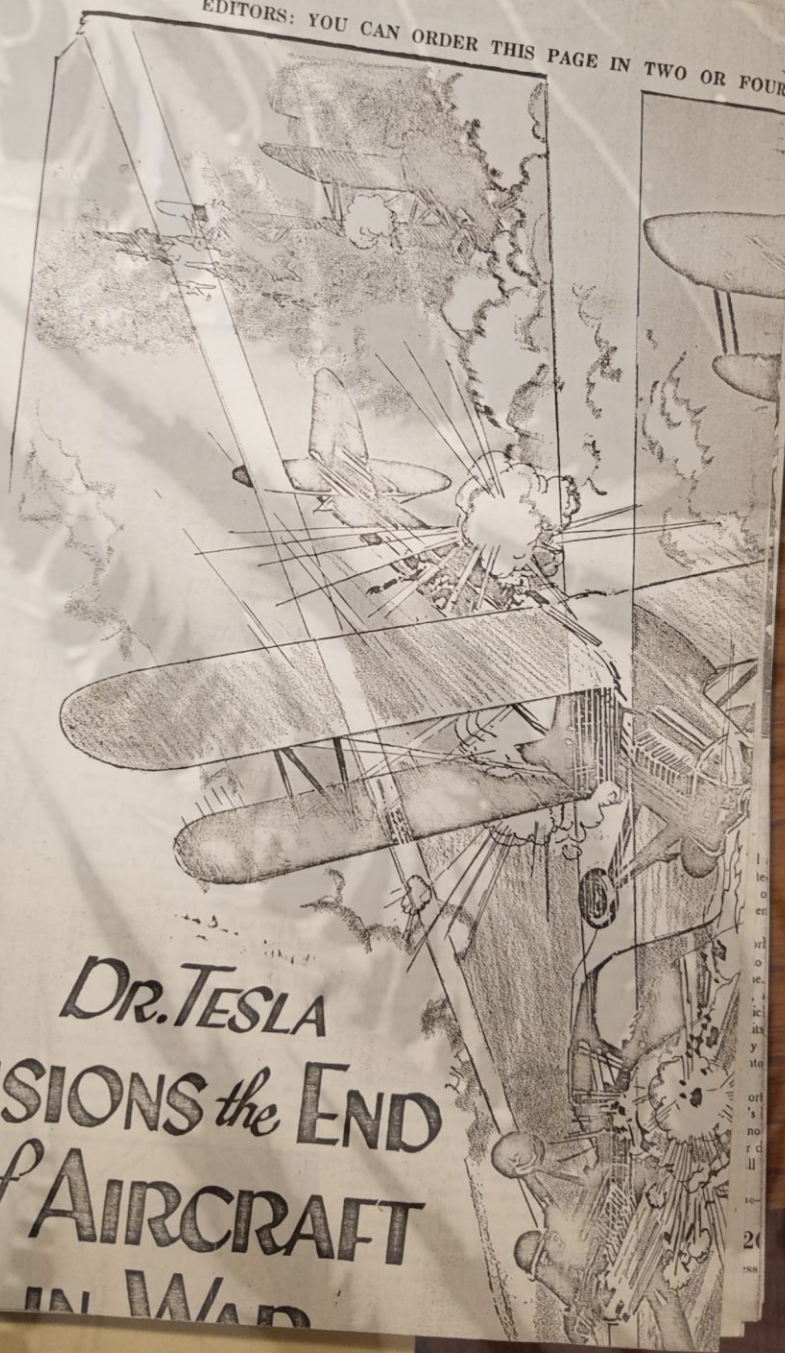
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N.Y. Tribune, August 18, 1935

EDITORS: YOU CAN ORDER THIS PAGE IN TWO OR FOUR

DR. TESLA
VISIONS the END
of AIRCRAFT
IN WAR



Box 8
Folder 1

EDITORS: YOU CAN ORDER THIS PAGE IN TWO OR FOUR COLORS AS WELL AS IN BLACK ONLY.—NEA SERVICE, INC.

DR. TESLA VISIONS the END of AIRCRAFT IN WAR

The famous inventor's new beam of death could bring down a fleet of 10,000 planes at a distance of 250 miles, he claims, and it also would make obsolete the submarine

If, occasionally, nations decide that they must have war just for the thrill of a shuddering down and a ringing battle, it can be stayed on the sea, Dr. Tesla says. Navy supremacy will hands down.

"The airplane will come to be used as a means of offense," the great inventor explains. "It will be sent entirely for peace, as it should be. An airplane, through the very nature of its construction, can not carry with it a generating plant for the beam. If it comes in contact with a country which is protected, it has no chance.

"The battleships will ride to sea safe from air raids, for they will be equipped with smaller plants for generating a beam of sufficient power to destroy any attacking airplane. But they will not be permitted to come near the shore of a protected country and attack it with any chance of success.

"The nation which has the best equipped battleships, however, will gain the supremacy of the seas. Submarines will be obsolete, for the methods of detecting them will be perfected to such a degree that there will be no longer any advantage in submarines.

Voltage never before attained, of 50,000,000 volts or more, will have to be applied.

The man who is responsible for so many discoveries and improvements has devoted his entire life to his scientific pursuits. Tall, lean, reserved, he pushes apart between the two small laboratories and the various manufacturing plants with which he has contact.

Born in Yugoslavia, Tesla comes from a race of inventors.

"On my mother's side, for three generations, almost all members of the families were inventors," he says. "My mother was Georgiana Mandic, who was named as an inventor of household appliances." One of the things which she perfected was her own sewing machine.

"Her family can be traced back to the seventh century, in the historical records. My grandfather was an officer in Napoleon's army."

TESLA began to invent at the age of six. As he grew up his interest focused in the laboratory.

"I sleep about one and one-half hours a night," the inventor says. "I think that is enough for any man. When I was young I worked more sleep. But now I don't require so much. There are so many things to do I do not want to spend time sleeping needlessly. In my family all were poor sleepers. Time spent in sleep is lost time, we always felt."

Tesla, busy with his 700 inventions, never had time for marriage. He never had a girl in his young days. He never had a romance. There was no lesson for them.

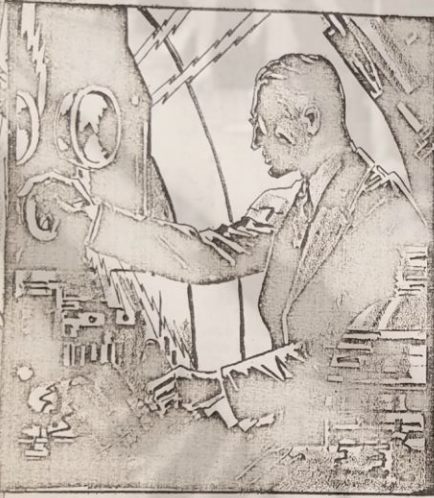
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An artist's conception of the way a technician, sitting in one of Dr. Tesla's great generating plants, would use the new beam to destroy hostile airplanes.

ic speed, and any amount
be transmitted by them.
at a gun, but one which is
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protected world, in which
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resembling forts placed at
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ace.

Week Magazine—Printed In U. S. A.)

When a submarine is located the beams will function under water, though not quite so effectively as in air."

FOUR new inventions of Dr. Tesla are involved in the creation of the beam.

"Briefly, the first comprises a method and apparatus for producing rays and other manifestations of energy in free air, eliminating the high vacuum heretofore indispensable," he explains.

"The second one is the process for producing electrical force of immense power.

"The third method amplifies the process, and the fourth produces a tremendous electrical repelling force."

In times of peace such a plant can be used to transmit power in any amount up to its full capacity and to any place on the earth visible through a telescope, according to its inventor.

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His diet is simple. He lives chiefly on vegetables, cereals and milk. The menu includes onions, spinach, celery, carrots, lettuce, with potatoes occasionally. Whites of eggs and milk complete the diet. There is no meat on his vegetable plate. He never smokes or tastes tea, coffee, alcoholic beverages or any other stimulant.

While he is perfecting the beam which will defend nations from attack, the inventor is playing with other ideas. He goes from one to the other, he says, as this or that gains paramount interest or some new clew is suggested.

"BUT what is giving me more fun than anything I have done for a long, long time," Dr. Tesla explains, "is an electric bath which I hope to have ready for general use very soon.

"It doesn't require much room. There is a platform on which the person stands. He turns on the current. Instantly all foreign material such as dust, dandruff, scales on the skin and microbes is thrown off from the body. The nerves, too, are exhilarated and strengthened. The 'bath' is excellent for medical as well as for cleaning purposes."

However, the war picture gives the master inventor more satisfaction than the minor inventions. He is rejoicing because his instrument of death will save millions of lives and inestimable property.

His only regret is that there may be another war before the discoveries he has made have been placed before the Disarmament Conference at Geneva, and generally adopted by the nations of the world.

"The next war, and I am afraid that there will be one before long," he says, "will be fought in the air. But if the beam is adopted war in the air will cease.

"Whatever battles there are thereafter will be confined to the sea. But no nation will dare to attack another nation when every country is armed. There will be a general feeling of safety throughout the world."

October 20-21, 1934. In Ordering Mat Designate Page 3, OCTOBER 21

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EDITORS: YOU CAN ORDER THIS PAGE IN TWO OR FOUR COLORS AS WELL AS IN BLACK ONLY.—NEA SERVICE, INC.

DR. TESLA VISIONS the END of AIRCRAFT IN WAR

By Helen Welshimer

"AMERICA Enters War!" "United States Joins Allies!" "Congress Declares War!" The newslayers were screaming the headlines through the rainy April night. Men and women stood on corners, talking, talking, talking—

The drift of the days went on. Troop trains pulled out of the stations, from Cantonville, Mississippi, up to Bangor, Maine. The drums thrummed and the trumpets blew. The ships sailed and the casualty lists came back. One by one the gold stars replaced the white—

And 1917 drifted into 1918.

Dr. Nikola Tesla was in his laboratory trying hard to solve a problem of ages. Once in a while he raised his head to listen. Then he turned back to his experiments. He was going to end war!

The noted inventor, 78 years old now, already had 700 inventions to his credit. This was to be his greatest.

Years marched on. The infantry and the drums were done. The dead were buried. The living came home.

NOW, 15 years after the war has ended, Tesla, one of the greatest inventors of all time, has announced that his invention to end all wars, by a perfect means of defense which any nation can employ, is ready. Soon, he says, he will take it to Geneva to present it to the Peace Conference.

Whether it is a dream or reality may soon be known. He claims to have created a new agent, silent and invisible, which kills without trace and yet pierces the thickest armor. It is a beam of death, and destruction formed of minute particles of matter carrying such tremendous energy that they could bring down a fleet of 10,000 attacking planes and wipe out an army of millions at a distance of 250 miles.

"The invention," says Dr. Tesla, "will make war impossible for it will surround any country with this means with an impenetrable, invisible wall of protection. Plans for the

generating of this beam will be erected along the coasts and near cities. One plant will afford perfect safety within an area of 40,000 square miles.

"The beam will be effective at any distance at which the object to be destroyed can be perceived through a telescope. Every country will have to adopt this invention, for without it a nation will be helpless.



Dr. Nikola Tesla.

"The beam, intended chiefly for defense, will be projected from an electric power plant, ready to be put in action at the first sign of danger. The cost of operation will be insignificant, as the plant is chiefly intended for use in emergency. But to make the investment profitable in times of peace it may be commercially employed for a number of purposes."

Dr. Tesla wishes it to be understood that the means he has perfected has nothing in common with the so-called "death ray."

"It is impossible to develop such a ray. I worked on that idea for many years," he says, "before my ignorance was dispelled and I became convinced that it could not be realized. This new beam of mine consists of minute bod-

ies moving at a terrific speed, and any amount of power desired can be transmitted by them, by a gun, but one which is incomparably superior to the present."

THE picture of a protected world, in which their time to pursuits of acinating one.

Imagine the map of the world, every country surrounded by a beam of death, the nation itself and its judges. Only ships flying at sea can sail into a foreign harbor.

The power plants, scrambling forts placed at strategic distances of a country's border, will be on guard. Any means for defense, and they will constitute a great advance in the cause of peace.

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"It doesn't require much room. There is a platform on which the person stands. He turns on the current. Instantly all foreign material such as dust, dandruff, scales on the skin and microbes is thrown off from the body. The nerves, too, are exhilarated and strengthened. The bath is excellent for medical as well as for cleaning purposes."

However, the water picture gives the master inventor more satisfaction than the minor inventions. He is rejoicing because his instrument of death will save millions of lives and insurable property.

His only regret is that there may be another war before the discoveries he has made have been placed before the Disarmament Conference at Geneva, and generally adopted by the nations of the world.

"The next war, and I am afraid that there will be one before long," he says, "will be fought in the air. But if the beam is adopted war in the air will cease."

"Whatever battles there are thereafter will be confined to the sea. But no nation will dare to attack another nation when every country is armed. There will be a general feeling of safety throughout the world."

An artist's conception of the way a technician, sitting in one of Dr. Tesla's great generating plants, would use the new beam to destroy hostile airplanes.

When a submarine is located the beams will function under water, though not quite so effectively as in air."

FOUR new inventions of Dr. Tesla are involved in the creation of the beam.

Briefly, the first comprises a method and apparatus for producing rays and other manifestations of energy in free air, eliminating the high vacuum heretofore indispensable, he explains.

"The second one is the process for producing electrical force of immense power."

"The third method amplifies the process, and the fourth produces a tremendous electrical repelling force."

In times of peace such a plant can be used to transmit power in any amount up to its full capacity and to any place on the earth visible through a telescope, according to its inventor.

EDITORS—This EveryWeek Magazine Page Releases Sat.-Sun., October 20-21, 1934. In Ordering Mat Designate Page 3, OCTOBER 21

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EDITORS: YOU CAN ORDER THIS PAGE IN TWO OR FOUR COLORS AS WELL AS IN BLACK ONLY.—NEA SERVICE, INC.

DR. TESLA VISIONS the END of AIRCRAFT IN WAR

By Helen Welshimer

"**A**MERICA enters war!" "United States joins Allies!" "Congress declares war!" The headlines were screaming the headlines through the rainy April night. Men and women stood in corners, talking, talking, talking. The drift of the days went on. Troop trains pulled out of the stations, from Cantonville, Mississippi, up to Hager, Maine. The drums thrummed and the trumpets blew. The ships sailed and the casualty lists came back. One by one the gold stars replaced the white. And 1917 drifted into 1918.

Dr. Nikola Tesla was in his laboratory trying hard to solve a problem of ages. Once in a while he raised his head to listen. Then he turned back to his experiments. He was going to end war!

The noted inventor, 78 years old now, already had 700 inventions to his credit. This was to be his greatest.

Years marched on. The fanfare and the drums were done. The dead were buried. The living came home.

NOW, 15 years after the war has ended, Tesla, one of the greatest inventors of all time, has announced that his invention to end all wars, by a perfect means of defense which any nation can employ, is ready. Soon, he says, he will take it to Geneva to present it to the Peace Conference.

Whether it is a dream or reality may soon be known. He claims to have created a new agent, silent and invisible, which kills without trace and yet pierces the thickest armor. It is a beam of death and destruction formed of minute particles of matter carrying such tremendous energy that they could bring down a fleet of 10,000 attacking planes and wipe out an army of millions at a distance of 250 miles.

"The invention," says Dr. Tesla, "will make war impossible for it will surround any country with a beam of death and destruction, invisible wall of protection. Plants for the

generating of this beam will be erected along the coasts and near cities. One plant will afford perfect safety within an area of 40,000 square miles.

"The beam will be effective at any distance at which the object to be destroyed can be perceived through a telescope. Every country will have to adopt this invention, for without it a nation will be helpless.



Dr. Nikola Tesla.

"The beam, intended chiefly for defense, will be projected from an electric power plant, ready to be put in action at the first sign of danger. The cost of operation will be insignificant, as the plant is chiefly intended for use in emergency. But to make the investment profitable in times of peace it may be commercially employed for a number of purposes."

Dr. Tesla wishes it to be understood that the means he has perfected has nothing in common with the so-called "death ray."

"It is impossible to develop such a ray. I worked on that idea for many years," he says, "before my ignorance was dispelled and I became convinced that it could not be realized. This new beam of mine consists of minute bod-

ies moving at a tremendous speed, and any amount of power desired can be transmitted by them, a gun, but one which is incomparably superior to the present."

THE picture of a man will disappear in their time to pursue of peace, it is strange, the world, every country surrounded by a shield of plants which will offer absolute protection against death to any ship sailing into a foreign harbor.

The power plants resembling forts placed at strategic distances at a country's border, will be on guard. Any ray is immovable, they will constitute a wall of defense, and by making invulnerable will greatly advance the cause of peace.

(Copyright, 1931, by EveryWeek Magazine—Printed in U. S. A.)

The famous inventor's new beam of death could bring down a fleet of 10,000 planes at a distance of 250 miles, he claims, and it also would make obsolete the submarine

If, occasionally, nations decide that they must have war just for the thrill of a flashing drum and a warring leader, it can be staged on the sea, Dr. Tesla says. Navy supremacy will remain inviolate.

"The airplane will cease to be used as a means of offense," the great inventor explains. "It will be used entirely for peace, as it should be. An airplane, through the very nature of its construction, can not carry with it a generating plant for the beam. If it comes in contact with a country which is protected, it has no chance."

"The battleship will ride to sea safe from air raids, for they will be equipped with smaller plants for generating a beam of sufficient power to destroy any attacking airplane. But they will not be permitted to come near the shore of a protected country and attack it with any chance of success."

"The nation which has the best equipped battleships, however, will gain the supremacy of the seas. Submarines will be obsolete, for the methods of detecting them will be perfected to such a degree that there will be no longer any advantage in submerging."

Vastages never before attained, of 10,000,000 volts or more, will have to be applied.

The man who is responsible for so many discoveries and improvements has devoted his entire life to his scientific pursuits. Tall, lean, reserved, he pulls apart the two small laboratories and the various manufacturing plants with which he has contact.

Born in Yugoslavia, Tesla comes from a race of inventors.

"On my mother's side, for three generations, almost all members of the families were inventors," he says. "My mother was Georgina Mandic, who was noted as an inventor of household appliances. One of the things which she perfected was her own sewing machine."

"Her family can be traced back to the seventh century, in the historical records. My grandfather was an officer in Napoleon's army."

TESLA began to invent at the age of six. As he grew up his interest focused in the laboratory.

"I sleep about one and one-half hours a night," the inventor says. "I think that is enough for any man. When I was young I needed more sleep. But age doesn't require so much. There are so many things to do I do not want to spend time sleeping needlessly. In my family all were poor sleepers. Time spent in sleep is lost time, we always felt."

Tesla, busy with his 700 inventions, never had time for marriage. He never had a girl in his young days. He never had a romance. There was no leisure for them.

His diet is simple. He lives chiefly on vegetables, corn and milk. The menu includes potatoes occasionally. Wholes of eggs and milk complete the diet. There is no meat on his vegetable plate. He never smokes or takes tea, coffee, alcoholic beverages or any other stimulants.

While he is perfecting the beam which will defend nations from attack, the inventor is playing with other ideas. He goes from one to the other, he says, as this or that gains paramount interest or some new clue is suggested.

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Tesla on Power Development and Future Marvels

By Nikola Tesla.

AM a reader of your excellent paper and frequently peruse its contents of interest to me for future reference.

One of these is an article by William Baker, in your issue of June 27, 1933, dealing with hydro-electric development in which the author characterizes my recent announcement of a new mechanical source of power as "nebulous."

A preliminary information is necessary, incomplete, but I always remain sure that it is based on concrete fact and accurate as far as it goes. My illustration, however, is correct, used to go twenty times over his scientific formula before giving them out, nevertheless, compared with the attention I bestow upon my own, he must have been considered a careless man.

The utilization of the new and everywhere prevalent power is a rational and practicable plan and not an illusory scheme like that of harnessing atomic energy, which still haunts many men of science under its spell, although there is absolutely no theoretical or experimental evidence to justify such expectation.

The author of the article gives an eloquent account of water power development, revealing vividly to my mind the almost impenetrable wall which success with my alternating system was almost insurmountable. It was not until the time when, after years of fruitless talking to deaf ears, I finally managed to be heard by a man, there was a man in the electrical industry towering above all others, like孙中山 over the Philistines. A genius of the first order, combining to an unequalled degree, inventive ability and mastery of business, a man truly great, of phenomenal powers—George Westinghouse. He espoused my cause and undertook to wage a war against overwhelming odds.

The alternating current was completely disregarded as a deadly and of no commercial value. Edison and his followers might be used for harnessing lightning to fry. Edison had a very poor opinion of my induction motor. The old interests were powerful and resolved to fight any encroachment on their business by all means fair or foul. But Westinghouse was not discouraged and threw all his energy and resources into the battle of the century. More than once he came near to being snuffed out, but finally he routed his opponents and put the new industry on a firm foundation. It was a monumental achievement unparalleled in the history of technical development. The service he rendered to the world is beyond estimate.

But it took another human dynamo, a genius of a different kind, Samuel Insull—to enlarge on the work of Westinghouse and apply the system on a colossal scale. Insull concentrated his efforts on cheapening the production, transmission and distribution of power. He recognized the economic advantages of early large units and prevailed upon the manufacturers to supply him with huge turbo-generators, regardless of cost. He introduced other improvements raising the efficiency and range of central stations and finally realized, practically and successfully, the Super Power System which I had sketched in 1893. The results he obtained were such as to astonish engineers, and his bold example was quickly followed here as well as in other countries, saving immense sums of money to the consumers.

At present the work of Westinghouse and Insull is carried further in every corner of the globe, providing new countries, transforming cities and communities and contributing to the safety, comfort and convenience of hundreds of millions. Let us think the stars that these great pioneers lived in our time, as otherwise we

Proportion.

By Henry N. Kost.

PEOPLE are talking much about what is wrong with our country. The wrong looks very big and threatening at times. But we don't have to fear. What is right with our country is so big that if our case is tried on the road we are, what is wrong becomes very small. In comparison with our country will constantly grow until what is wrong will be lost sight of and go to its native nothingness.

Liberty, N. Y.

might have had to wait a century for the benefits we now enjoy.

Another item of interest to me is your flattering editorial of July 12, 1934, with a fit in the statement, "you state that examination of your performance does not in recent years fulfill my prophecy. Perhaps not," I am glad to know how many of my predictions and inventions are in extensive use. To give an illustration, I refer to my wireless system of transmission of energy which is looked upon by many as a pipe dream.

These uniformed people should be told that "wireless" is not a single invention but an art involving the use of many of the, and of these I have contributed the fundamental and most essential, and they are universally employed. There is as yet no pressing necessity for wireless transmission of power in industrial amounts, but as soon as it arises the system will be applied with perfect success.

Still another item which has interested me is a report from Washington in the World-Telegram of July 12, 1934, to the effect that scientists doubt the death ray effect. I am quite in agreement with these doubts in this respect from any other ray for a

Ray of the requisite energy can not be produced and then again that intensity diminishes with the square of the distance. Not so the agent I employ, which will enable us to transmit to a distant point billions of times more energy than is possible by any kind of ray.

We are all fallible, but as I examine the subject in the light of my positive theoretical and experimental knowledge I am filled with deep conviction that I am giving to the world something far beyond the wildest dreams of inventors of all time.

New York.

Asking the Churchgoer for Added Contribution.

By Patrick F. Scanlan, Managing Editor for the Brooklyn Tablet.

Mr. Stetle asked the churches to give \$2,500,000 a year for public relief. I showed they are giving far more than that now. Mr. Stetle said the churches are exempt from \$10,000,000 of taxes. I showed they render services four or five times the total of that amount. Mr. Stetle replied by repeating his demand.

John Jones on my block goes to church every Sunday. Besides contributing to the upkeep of the church, he gives approximately \$20 a year to unemployment relief and \$20 to the upkeep of the parish school. This \$40 represents a contribution to public welfare—to the city's needs. The families next door to Mr. Jones do not go to church. They do not contribute to unemployment relief through the church or to educational work.

Mr. Stetle's suggestion is not that the latter contribute anything but that the former give more than he is already giving. It is a demand, not a proposal, unreasonable and unjust. Brooklyn.

John Mr. Steingut

Known by Best Citizens.

A former resident of Brooklyn who has been identified for more than a quarter of a century with all movements for civic and betterment, I must enter earnest protest against your indiscriminate attack on Irwin Steingut, minority

Thinks Mr. Farley May Be Champion Humorist.

By S. Satterfield.

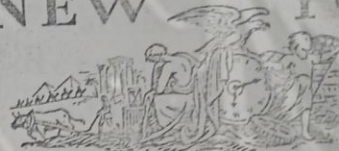
Our peripatetic Postmaster General, James A. Farley, is certainly a born comedian, if nothing else. Farley is now gallivanting about the country proclaiming to all who will hear: "During Mr. Roosevelt's long period in office, embracing two successful terms, as Governor of New

WORLD TELEGRAM
JULY 24, 1934

you launch an attack in an hour now. Finally there was the churchgoer, who, when outside of school are also

NEW YORK

Herald



THE WEATHER

Today: Fair and warmer
Tomorrow: Fair and warmer,
followed by showers
Temperatures Yesterday: Max. 79; Min. 67
Detailed Report on Page 24

Vol. XCIV No. 32,014

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WEDNESDAY, JULY 11

Republicans Offer County Reforms for Entire State

County to Go 'Whole Way'
with Lehman Plan for
Duplication in the
Name of Government

The County
Offering a 'Surprise'
to the Legislature Opens

Amendments
to the Bill
and believed that
the national-so-
cialist Schutz-Staffel
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Beam to Kill Army at 200 Miles, Tesla's Claim on 78th Birthday

Death Ray Also Available
as Power Agent in Peace
Times, Inventor Declares

By Joseph W. Alsop Jr.

Dr. Nikola Tesla, inventor of poly-
phase electrical current, pioneer in
high frequency transmission, pre-
decessor of Marconi with the wireless,
celebrated his seventy-eighth birth-
day yesterday by announcing his in-
vention of a beam of force somewhat
similar to the death ray of scientific
romance.

It is capable, he believes, of de-
stroying an army 200 miles away;
it can bring down an airplane like
a duck on the wing, and it can pen-
etrate all but the most enormous
thicknesses of armor plate. Since it
must be generated at stationary
power plants by machines which in-
volve four electrical devices of the
most revolutionary sort, Dr. Tesla
considers it almost wholly a defen-
sive weapon. In peace times, he says,
the beam will also be used to trans-
mit immense voltages of power over
distances limited only by the curva-
ture of the earth.

As a hors d'oeuvre to this Jules
Verne announcement, Dr. Tesla dis-
closed that he has lately perfected
instruments which flatly disprove the
present theory of the high physicists
that the sun is destined to burn it-
self out until it is a cold cinder

floating in space. Dr. Tesla stated
that he is able to show that all the
suns in the universe are constantly
growing in mass and heat, so that the
ultimate fate of each is explosion.

Dr. Tesla refused to describe spec-
ifically the instruments in question
in both discoveries, or even to dis-
close the principles upon which they

(Continued on page 17teen)



Herald Tribune photo—Steffen
Nikola Tesla

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ifically the instruments in question
in both discoveries, or even to dis-
close the principles upon which they

(Continued on page 17teen)

Bid Too Low, City Refuses To Sell Bonds

Banks 'Ganged' to Get
\$72,000,000 Issue at
Cheap Price, LaGuardia
Says After 4% Offer

May Seek Private
Investors' Market

Wall St. Defends Yield
Basis and Insists Huge
Syndicate Was Justified

The city's widely heralded \$72,000,000
bond and corporate stock sale
failed to come off yesterday after Mayor
F. H. LaGuardia and Comptroller Jo-
seph D. McGoldrick and other mem-
bers of the Sinking Fund Commission
had read the five tenders for the issue
submitted by a banking syndicate
headed by the Chase National Bank
and the banking firm of Henry Clews
& Co. and the Emigrant Industrial
Savings Bank.

All the bids except that of the sav-
ings bank, which was for but \$2,000,000
of the serial bonds, were rejected and
the good-faith deposit checks returned
to the bankers. And after them went
a thundering denunciation by Mayor
LaGuardia.

Accuses Banks of "Gangling"

The Mayor charged that the banks
had "ganged" to put in an unfair
tender. He warned them that he
would give them one more chance to
make an honest, bona fide offer.
They didn't accept that chance, he
said, and they would get the money elsewhere.

The bids were opened in the Con-
troller's office at noon. It was a rather
momentous occasion, as the city was
about to receive bids for the first in-
term bond issue in more than 10
years. The Mayor and Bernard
Deutsch, President of the Board
Aldermen, stood by, tensely expect-
ing as the bids were taken from the
Comptroller McGoldrick began
reading the tenders, but it was not
before it was apparent that the

U.S. Revenue Up Billion Over '33, Report Shows

Processing Taxes, Levied
for First Time, Account
for 371 Millions of Gain

From the Herald Tribune Bureau

WASHINGTON, July 10.—Internal
revenue collections increased in the
fiscal year 1934 over 1933 by more
than \$1,000,000,000. Detailed tabula-
tions made public today by Guy T.
Helvering, Commissioner of Internal
Revenue, showed that agricultural
processing taxes, which were imposed

Colombia Hails Roosevelt as He Pays Brief Visit

Destroyers Greet President,
Then Olaya Rides Through
Crowded Streets With Him

By The United Press

CARTAGENA, Colombia, July 10.—
In a gesture of good will President
Roosevelt stepped on foreign soil here
today and extended greetings from the
people of the United States to their
neighbors in Latin America.

Against a background of widely
gathering multitudes of natives, the

Women Testify To Reno Losses At Bunco Trial

Kathryn Beeson Says She Was Swindled of \$177,000 by Pocketbook Trick

Other Lost Life Savings

Third Victim Got 'Rubber' Check for Consolation

At the trial of William J. Graham and Leawane C. McKee, political and gambling powers of Reno, Nev., and John L. Egleston, of Worcester, Mass., continued yesterday in United States District Court with the testimony of two women who had been swindled for more than a quarter of a million dollars. The men are being tried before Judge Carroll C. Hicks and a jury on charges of using the mails to defraud.

Miss Kathryn Beeson, member of a prominent Pennsylvania family and a sister of Charles Beeson, steel magnate, repeated the story she had given at previous trials, relating how she had been nearly swindled of \$177,000 by two obscure acquaintances who employed the old pocketbook trick to do the job. One of the swindlers, Frank G. Davis, is now serving a four-year and-a-half-year term in the penitentiary at Atlanta.

Mrs. Mary E. Callahan, who, with her husband, the late John H. Callahan, was proprietor of a Rochester hotel, took the stand and testified that while she and her husband were traveling in California they were hoodwinked out of \$141,000—all but \$4,000 of their life savings—by virtually the same method used by Davis and his confederates on Miss Beeson. Mrs. Callahan identified Noble John Moore, whom she knew in California, as Jack Corbett, and Egleston as those who had swindled her. Both Moore and Egleston were convicted of defrauding the Callahans, although the former is not on trial. He is expected to testify as a government witness.

Graham and McKee, the two principal defendants, are accused as leaders of the nation-wide bunco ring which centered its operations in Reno. In the case of each of the alleged victims of the ring, the Riverside Bank in Reno was used for the transfer of funds or liquidation of securities into cash for betting on horse races or playing the stock market.

Edward Gilmore, retired Chicago business man, finished his testimony begun on Monday and introduced a new variation in the game. He said that instead of sending him out of Reno empty-handed the swindlers who had persuaded him to put up \$150,000 to collect a large wager on a horse race, all of which he eventually lost, "made it up to him" by drawing a check for the amount on the Chase National Bank. The check, later proved to be worthless, however.

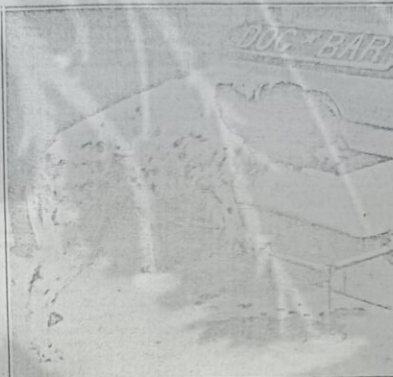
Others who told stories of being victimized by the bunco gang were James Montgomery, a section foreman of a construction company, who told how he was swindled out of \$100,000 at a building factory. Mr. Herold said he became entangled with the operators, swindling machine in April, 1931, when he met two operators in Los Angeles. After the bunco game had been played and Mr. Herold was on the point of handing over \$23,000 to the confidence men, confusion over a look him at the last moment. He refused to part with the money, beaten in a Reno fight, discussing the proposition, none was offered him a clear. The next thing he knew, Mr. Herold said, was that he was off to Buffalo on a train. His money was gone and he would give no explanation for the absence.

The trial will continue at 10 a. m. today.

Mr. Rainer Stamp Design Is Announced by Farley

Issue Will Be Placed on Sale

Atlantic City Dog Bar Now Open for Business



And one of its features is that the patrons don't have to pay anything for drinking water. A veterinarian paid for its construction

Beam to Kill Army at 200 Miles, Tesla's Claim on 78th Birthday

(Continued from page one)

are built. He said that at some date soon he expected to make the full details public in scientific journals or before scientific bodies. Since he considers the beam of force a defensive and therefore a pacifist weapon, he hopes to be able to present it in full for the first time at the disarmament conference at Geneva. He also said that neither part of each of the discoveries are still in the theoretical, or blueprint stage, but he pointed out that his method of work has almost always been purely mental.

Inventor Reviews Past The aging inventor, a tall, thin, almost spiritual figure in the sort of brown outworn suit that older men wore before the World War, received interviews in one of the public rooms in the Hotel New Yorker, where he lives. Before he would speak of his present work he reviewed his past achievements, which entitle him, more than Edison, Einstein or any other, to be called the father of the power age. He has 30 patents to his credit, and not a few of them are for groundbreaking discoveries, but over and over again he has been ridiculed as a tumbler. He recalled this and his work together, as if to prepare the way for his announcements.

He came to the idea of a beam of force, he said, because of his belief that no weapon has ever been found that is not as successful offensively as defensively. "The perfect weapon of defense, he felt, would be a force, wall, impenetrable and extending up to the limits of the atmosphere of the earth."

Creates Rays in Eye Air Such a wall, he believes, is provided by a combination of four classical methods of apparatus. First and most important is a mechanism for producing rays and other energy manifestations in free air. Jutheta vacuum tubes have always been necessary, second, an apparatus for producing, behind or quantities of electrical current and for controlling it when produced. The current is necessary as power for the first mechanism. Without this no rays of sufficient strength could be produced. The third is a method of intensifying and amplifying the second process, and the fourth is a method of producing "free" electrical repellent force.

"These four inventions in combination enable man to lose in free air force beyond conception," Dr. Tesla remarked mildly. "By scientific application we can project destructive energy in three-dimensional space as a telescope can discern an object. The range of the beam is only limited by the curvature of the earth. Should you listen an attack in an area cov-

most positive accuracy. Like many other things I have done they require no previous experiment once they are properly conceived. There are a few details to be finished—my calculations might be perhaps 10 per cent off at present—and then the whole thing will be presented to the world. It has always been my practice to give the world a sort of preview of what I am doing so that a reception is prepared."

Power Supply Unlimited "I should also say, and this is perhaps as important as anything else about it, that in this apparatus a limitation as to electric force and the quantity of electricity transmitted have been removed."

It was evident that Dr. Tesla's work on the force beam as a peace-time means of power transmission was far less advanced than his work on it as a defensive weapon. He did not describe the nature of the receiver which will transform the force beam into useful power, though he declared that he had designed one, nor was he able to show just how the dangers of having such death-dealing but invisible beams traveling through the air could be surmounted.

Dr. Tesla was far less definite in his description of the experiments which led to his revolutionary prediction of the future of the sun and the system than he was when talking of the force beam. He had, he said, detected "certain motions in the medium that fills space, and measured the effects of these motions." The results of the experiments had led him "inexorably" to the conclusion that such bodies as the sun are taking on mass much more rapidly than they are dissipating it by the dissipation of energy in heat and light.

"That to Kill All Peoples" He pointed out that his theory means a future for the earth as different from the general belief as the future of the sun. It is generally held that life on the earth will cease when the sun grows so cold that the earth's temperature drops to a point where life can no longer be supported. Dr. Tesla prophesied that life on the earth will cease because the plants will grow too warm to support life, and he believes that life will then begin on outer planets now too cold. He said that his discovery not only allowed him to predict a very different future for the heavenly bodies but that now generally accepted for them, but also to calculate in a new way their ages.

Nor were these two discoveries of a new kind and a new future for the universe the only new things Dr. Tesla had to offer. The completely new and startling discovery of energy which he stated he was at work on, he said, had been examined by him. Since his first spoke of it great strides have been made, and the complete announcement of it is to be expected in a comparatively short time. Finally there was the electric bath,

Paralysis Held Hereditary in Harvard Survey

Evidences of Family Susceptibility Discovered in 2 P. C. of Clinic Cases

May Affect Use of Serum

Discovery Hailed as Greatest Advance in Many Years

(Special to the Herald Tribune)

CAMBRIDGE, July 10.—Susceptibility to infantile paralysis is due to an inherent constitutional deficiency, a possibility previously unconsidered, it was stated today by Dr. W. Lloyd Aycock, of the Harvard Infantile Paralysis Commission. The conclusion was reached as a result of exhaustive experiments conducted by Dr. Aycock and his colleagues over a long period of years.

Dr. Aycock, an authority on the dread polio-myelitis, has, it is believed, made the most important discovery in years in aid of science's perennial fight against the disease. While Dr. Aycock hastened to stress that the conclusion regarding inherited susceptibility in no way resembles a "cure," he does believe that this new fact concerning the disease will permit a promising method of attack.

"It may indicate," said Dr. Aycock, "what some organs are unable to do the work necessary to combat the polio-myelitis virus and it may be that if it can be identified the trouble can be remedied. Or," he continued, "it may enable us to select the relatively small proportion of susceptibles from the many and protect them by extraordinary precautions too drastic for general application."

35 Per Cent Had Family History An intensive study, Dr. Aycock explained, resulted in the discovery. Working at the Boston Clinic of the Commission, it was found that 35 per cent of those treated had a family history of the disease. In three well isolated communities in Vermont, Watford, Barton and Grand Isle—still stronger evidence was found that susceptibility is hereditary for 31 per cent of the patients treated had a family history.

Studying children that had the disease, then waiting while they married and had children of their own who contracted the disease, Dr. Aycock was able to trace the disease through two generations, an essential in the study of hereditary traits. Whole families also were studied. In one case paralysis was found in as many as five generations of a single family tree, and in another nineteen cases were discovered in a single family over a period of forty years.

During the tests particular care was taken to eliminate the possibility that the disease had been transmitted by infection or contagion. "On the speculation that such cases might arise out of an infected house, or lack of cleanliness," says Dr. Aycock, "there is the further fact, one of a number, in which one child was stricken in Nova Scotia and one of the younger children was a victim after the family had moved to Massachusetts."

"Another case," he said, "is the record of a case in Massachusetts, where another member of the family who had never seen the first and who lived in Italy also contracted the disease." That the disease skips generations presumably possessed of the same susceptibility is explained by Dr. Aycock in that not every one has his susceptibility tested by exposure to the virus.

May Aid Use of Serum

The nature of the fight in view of this discovery, has not yet been determined as yet, but the hereditary theory offers additional possibilities in the use of serum. The value of serum in the fight has thus far not been definitely proved, but is Dr. Aycock's belief that future work on this project will be greatly aided by the commission's discovery.

Dr. Aycock summarizes the new advance in research as follows:

"1. It tells us a piece of truth. 2. It may enable us to select the relatively small proportion of susceptibles from the many and protect them by extraordinary precautions too drastic for general application. 3. To close schools is undesirable in any event unless gatherings of children outside of school are also pro-

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in Beeson, member of a Pennsylvania family and a steel magnate. The story she had given him, relating how she had been swindled of \$177,000 by acquaintances who had used her old pocketbook trick to get money from her. One of the swindlers, a man named E. Callahan, is now serving a four-year term in the penitentiary.

E. Callahan, who, with the late John H. Callahan, proprietor of a Rochester stand and testified that he and her husband were swindled of \$141,000—all but her life savings—by the same method used by Davis in the case of Miss Beeson. He identified Noble John Callahan, whom she knew in California, as the man who had swindled her. Both Moore and Callahan, although the latter was on trial, he is expected to testify as a government witness.

McKay, the two principals, are accused as back-nation-wide bunco ring operators in Reno. Each of the alleged operators, the Riverside Hotel, was used for the transaction of liquidation of securities for betting on horse racing.

Illsford, retired Chicagoan, finished his testimony Monday and introduced a man in the game. He said that he had sent him out of the hands of the swindlers who had him to put up \$150,000, a large wager on a horse race, which he eventually lost, up to him by drawing a check for the amount on the Chase Bank. The check later proved worthless, however.

He had told stories of being swindled by the bunco gang were thin, a section foreman given who lost \$25,000, his name and name of the factory. Mr. Hermel said that he was entangled with the swindling machine in April, 1914. He met two operators in the game. After the game was played and Mr. Hermel was left with \$25,000, he was left with the last moment. He went out with the money. Seated at the resort, discussing the matter, some one offered him a check for the money. The next thing he knew, Mr. Hermel was off to a train. His money was gone and he could give no explanation.

He will continue at 10 a. m.

**Printer Stamp Design
Announced by Farley**

All Be Placed on Sale

And one of its features is that the patrons don't have to pay anything for drinking water. A veterinarian paid for its construction

Beam to Kill Army at 200 Miles, Tesla's Claim on 78th Birthday

(Continued from page one)

are built. He said that at some date soon he expected to make the full details public in scientific journals or before scientific bodies. Since he considers the beam of force a defensive and therefore a pacifist weapon, he hopes to be able to present it in full for the first time at the disarmament conference at Geneva. He also said that minor parts of each of the discoveries are still in the theoretical, or blueprint stage, but he pointed out that his method of work has almost always been purely mental.

Inventor Reviews Past

The aging inventor, a tall, thin, almost spiritual figure in the sort of brown cutaway suit that older men wore before the World War, received interviewers in one of the public rooms in the Hotel New Yorker, where he lives. Before he would speak of his present work he reviewed his past achievements, which entitle him, more than Edison, Steinmetz or any other, to be called the father of the power age. He has 300 patents to his credit, and not a few of them are for epoch-making discoveries, but over and over again he has been ridiculed as a lunatic. He recalled this and his work together as if to prepare the way for his announcements.

He came to the idea of a beam of force, he said, because of his belief that no weapon has ever been found that is not as successful offensively as defensively. The perfect weapon of defense, he felt, would be a frontier wall, impenetrable and extending up to the limits of the atmosphere of the earth.

Creates Rays in Free Air

Such a wall, he believes, is provided by his beam of force. It is produced by a combination of four electrical methods or apparatuses. First and most important is a mechanism for producing rays and other energy manifestations in free air. Hitherto vacuum tubes have always been necessary. Second is an apparatus for producing unheard-of quantities of electrical current and for controlling it when produced. The current is necessary as power for the first mechanism. Without this, no rays of sufficient strength could be produced. The third is a method of intensifying and amplifying the second process, and the fourth is a method of producing tremendous electrical repellent force.

"These four inventions in combination enable man to loose his free forces beyond conception," Dr. Tesla remarked mildly. "By scientific application we can project destructive energy in thread-like beams as far as a telescope can discern an object. The range of the beams is only limited by the curvature of the earth. Should you launch an attack in an area cov-

most positive accuracy. Like many other things I have done they require no previous experiment once they are properly conceived. There are a few details to be finished—my calculations might be perhaps 10 per cent off at present—and then the whole thing will be presented to the world. It has always been my practice to give the world a sort of preview of what I am doing so that a reception is prepared."

Power Supply Unlimited

"I should also say, and this is perhaps as important as anything else about it, that in this apparatus all limitations as to electric force and the quantity of electricity transmitted have been removed."

It was evident that Dr. Tesla's work on the force beam as a peace-time means of power transmission was far less advanced than his work on it as a defensive weapon. He did not describe the nature of the receiver which will transform the force beam into useful power, though he declared that he had designed one, nor was he able to show just how the dangers of having such death-dealing but invisible beams, traveling through the air, could be surmounted.

Dr. Tesla was far less definite in his description of the experiments which led to his revolutionary prediction of the future of the sun and his system than he was when talking of the force beam. He had, he said, detected "certain motions in the medium that fills space, and measured the effects of these motions." The results of the experiments had led him, "inseparably" to the conclusion that such bodies as the sun are taking on mass much more rapidly than they are dissipating it by the dissipation of energy in heat and light.

"Beat to Kill All Peoples"

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Nor were these two discoveries, of a force beam and a new future for the universe, the only new things Dr. Tesla had to offer. The completely new and unlimited source of energy which he stated he was at work on is, he said, still under examination by him. Since his first spoke of it great strides have been made, and the complete announcement of it is to be expected in a comparatively short time.

Finally there was the electric bath. This is a bath of electricity in

polymyositis, nas, it is being the most important discovery in aid of science's perusal against the disease. While I hastened to stress that the regarding inherited susceptibility no way resembles a "cure," I believe that this new fact concerning disease will permit a promise of attack.

"It may indicate," said Dr. Aycock, "that some organs are unable to do the work necessary to combat polymyositis virus and it may be that it can be identified and can be remedied. Or, 'he said, 'It may enable us to select relatively small proportion of babies from the many and protect by extraordinary precautions for general application.'"

20 Per Cent Had Family History

An intensive study, Dr. Aycock, resulted in the Working at the Boston Clinic Commission, it was found that 20 per cent of these treated had a history of the disease. In isolated communities in Vermont, Waitsfield, Barton and Grand Isle, still stronger evidence was found that susceptibility is hereditary. 10 per cent of the patients treated had a family history.

Studying children that had the disease, then waiting while they and had children of their own, Dr. Aycock was able to trace the disease through generations, an essential in the hereditary theory. Whole families were studied. In paralysis was found in as many generations of a single family in another nineteen cases covered in a single family period of forty years.

During the tests particular taken to eliminate the possibility of the disease had been transmitted by infection or contagion. "On the whole, that such cases may be out of an infected house, or cleanliness," says Dr. Aycock, "the further fact, one of a number which one child was stricken in Scotland and one of the children was a victim after they had moved to Massachusetts."

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May Aid Use of Serum

The nature of the fight, in this discovery, has not been defined as yet, but the theory offers additional possibilities for the use of serum. The value of the fight has thus far not definitely proved, but is Dr. Aycock's belief that future work on this will be greatly aided by the discovery of the virus.

Dr. Aycock summarizes the advance in research as follows:

1. It tells us a piece of truth.
2. It may enable us to select relatively small proportion of babies from the many and protect them by extraordinary precautions for general application.
3. To close schools is undesirable unless gatherings of children outside of school are also

Tesla's Wireless Power Dream Nears Reality

Boise City, Okla., April 1 (U.P.)—Nikola Tesla's forecasts of commercial transmission of electric power without wires tonight appeared near realization.



Nikola Tesla.

Equipment was being made ready for a test run of a motor car over a stretch of railway track to Farley, N. M., with power supplied by radio. Success would open an ultra-modern system of transportation. The run is expected to be made as soon as the most efficient mechanical method is determined for transferring energy from the radio-

impelled motor to the car drive wheels. Test runs in the Santa Fe Railway yards here during the week recalled the experiments Tesla began thirty years ago with wireless transmission of signals and power. Two Californians developed the equipment here, however.

Plans Wireless Hydro-Electric

Tesla, the Serbian-American electrical genius, produced incandescent effects in lamps without filaments in 1903 and performed other weird feats without wires. Now, almost 77, he still is experimenting in New York and has designed a plant for wireless transmission of hydro-electric power, which he proposed should be erected at Niagara Falls.

Details of how the radio-powered motor car equipment works are

closely guarded secrets, but were understood to involve use of high frequency current and short wave radio with receiving elements similar to those in television sets.

Predicts New Home Machinery

Use of high frequency currents was the basis of Tesla's phenomenal early experiments which led him to predict that some day houses would be lighted and electric machinery run without wires connecting them to power plants.

An odd-looking set of electrical and gasoline motored apparatus including a high-powered radio transmitter with big coils and short antenna, has been set up here to wait current to the specially-motored car for the run of 30 to 40 miles.

CHEAP CHAMPAGNE

Champagne cocktails reached a new low post-repeal price yesterday when the Hotel Roosevelt sold them for 50 cents at the bar. The announced aim was to push American champagne.

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BOROUGH HALL
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1 DeKalb Ave. Room 401
ALICE CLUSTON Bldg.
MAINE SQUARE
FLATIRON
303 Flatiron Avenue
Exchange 2-1111 Cane Ave.</p> |
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wards which it leans, in the direction of the opposite side where the reverse condition exists. It is well to remember this in such a storm. If the observer sees a leaning funnel, he is in no immediate danger, but if the funnel appears straight he should run for shelter at once.

is a startling new book about sex, says any other you have ever before. It is a book written especially for men and women who are not sure of the facts, and who want to learn the truth about sex and sexual behavior.

This is a startling new book, by Dr. William H. Masters, discusses in the plainest language everything pertaining to the sex and its behavior in marriage and out of it. Is it worth the trouble of reading only as it concerns sex? It might be thought of love as being possible only in marriage? It might be thought of love and many more are discussed open questions, and frankly in this great book. It gives you an amazing new view of the whole question of sex, as seen by the famous Sexologist whose works are praised by the world.

This Partial Table of Contents gives you a faint idea of the value and the completeness of Dr. Wm. J. Robinson's wonderful new book, entitled:

- Principles of General and Sexual Morality
- Promiscuous Relations
- Extra-Marital Relations, with 10 Illustrations
- When Love Complicates the Problem
- Frankness Between Husband and Wife
- The Domestic Trio
- Love and Sexual Intercourse
- Wrong View of Sanctions
- Three Grades of Love
- Sexual Favoritism
- The Double Standard
- Unnatural Methods of Love
- Definition of Prostitution
- Prostitute's Moral Level
- Prostitute's Mental Level
- Ethics of Prostitution

Does Prostitution Supply
a Genuine Need?
Will Prostitution Ever
Disappear Entirely?
What to Do With the
Prostitute
Three Kinds of Prosti-
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Homosexuality, Transves-
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Rape
Incest
Masturbation
Abortion
Preconception or Birth
Control
Divorce
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wards which it leans, in the direction of the opposite side where the reverse condition exists. It is well to remember this in such a storm. If the observer sees a leaning funnel, he is in no immediate danger, but if the funnel appears straight he should run for shelter at once.

large willow be easy to show how a large and very heavy body, such as a locomotive, can be lifted by the tornado or a cyclone to a considerable distance. American locomotives which are the biggest in the world, weigh about 150,000 pounds. The width of 11½ feet, presenting thus 760 sq. ft. in horizontal projection. At the moment of the explosion of the cyclone, the wheels, connections and other parts under the main body arrest the motion of the locomotive. The pressure of 138 pounds per square foot, in excess of that of the atmosphere, will lift the locomotive 11½ feet. But, to lift the locomotive 100 feet, a pressure, a pressure difference of four atmospheres of mercury (that is, two pounds per square inch) is required. A pressure of 138 pounds per square foot is maintained, making the pressure difference between the atmosphere and the cyclone 288-138=150 pounds per square foot. The total upward push exerted on the locomotive is 150 x 760=114,000 lbs. thus 323,760 pounds, which is much more than the weight of such a locomotive, 113,760 pounds, and 113,760 pounds when fully equipped for service.)

Ordinarily, the weight should be much smaller; and one can readily see that the vehicle may be instantly raised in a spiral, accelerated and hurled away tangentially to great distance. The average person may be surprised that an insignificant vacuum is sufficient for so stupendous a display of force; but the figures afford an unmistakable proof. I may add that I have assumed minimum values which will be, in all probability, greatly exceeded.

The constant fear of danger from tornadoes and the great losses of life and property which they cause in certain parts make it very desirable to find some means of effectively combating, if not preventing them. Whenever man attempts to interfere with the order of things determined by immutable laws, he finds that his efforts are utterly insignificant when compared with the vast movements of energy in Nature.

One of the greatest possible achievements of the human race would be the control of the precipitation of rain. The sun raises the waters of the ocean and winds carry them to distant regions, where they remain in a state of delicate suspension until a relatively feeble impulse causes them to fall to earth. The terrestrial mechanism operates much like an apparatus releasing great energy through a trigger or priming cap.

If man could perform this relatively trifling work, he could direct the life-giving stream of water wherever he pleased, create lakes and rivers and transform the arid regions of the globe. Many means have been proposed to this end, but only one is operative. It is lightning, but of a certain kind.

More than 35 years ago, I undertook the production of these phenomena and, in 1899, I actually succeeded, using a generator of 2,000 horsepower, in obtaining discharges of 15,000,000 volts carrying currents of 1,200 amperes, which were of such power as to be audible at a distance of 13 miles. I also learned how to produce just such lightnings as occur in Nature, and mastered all the technical difficulties in this connection. But I found that even the small,

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and comparatively negligible bigger work called for the employment of thousands of fore-power and this is the great obstacle now in the way of this supreme accomplishment, it is such difficulty would be encountered in our attempts to control tornadoes because, as before stated, these

on - Articles - 1900

...to President Roosevelt, who soon will meet with Maxim Litvinoff, Soviet Commissar for Foreign Affairs.

TESLA CLAIMS MACHINE
TO TAP COSMIC ENERGY

Published, 1933, by New York American, Inc.
Registered at U. S. Patent Office. EDITORIAL PHOTOS
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HUGO GERNSBACH, EDITOR

H. WINFIELD SECOR, MANAGING EDITOR



Unknown Short Waves

An Editorial By HUGO GERNSBACH

● WE ARE apt to talk quite glibly about short waves—day in and day out. We use the instrumentality of short waves to receive music and talk from the Antipodes, and we use them for dozens of our other requirements, day in and day out; but, when it comes to the waves themselves, practically nothing is known about them! They are still a book sealed tight with seven seals.

So far, most of our experimental and research work has been concerned with the generation and the effect of short waves; but what happens to these waves between the transmitting antenna and your receiving set is still a deep mystery.

While we know in a general way that waves are reflected by the so-called Kennelly-Heaviside and Appleton layers, which gives rise to "skip effects," very little is known out side of this fact. We do know that the upper rarefied atmospheric strata reflect the radio waves, somewhat as a curved mirror would reflect light; still, this statement does not always hold true either, and other things are happening, most of which we do not understand as yet.

For instance, only recently, Signor Marconi on his yacht "Electra" did some constructive experimental work upon a 3/5-meter band. Normally, the effect of such a wave should not go beyond the horizon; because at these ultra-short wavelengths, as scientists think, the waves assume the physical characteristics of light, and therefore cannot go beyond the horizon, any more than a searchlight can go around the curve of the earth.

It is true that, as Marconi pointed out, light waves suffer a certain amount of refraction; so that you actually can see them a little below the horizon, but not much. This, however, does not explain how Marconi could send and receive short waves over a distance of 160 miles, when a light beam would not go more than fifty miles at the most.

We are, therefore, face to face with a new mystery of short waves; since they do not seem to behave "according to Hooke." Something else happens here that we do not understand. The chances are that at this point our good friend Dr. Nikola Tesla steps into the breach. For many years, this illustrious savant, the most distinguished living inventor of today, has claimed that all radio transmission, whether on long or short waves, is not done by free waves in space at all, but that it is done by currents transmitted through the earth! Asked by me some years ago, how he explains transmission from an airplane to the ground,

Tesla stated that this is nothing but a condenser or capacity effect, wherein the ground was one plate and the plane another. This is not at all illogical, when it is considered that submarines can send and receive radio messages while totally submerged; always providing that their aerials are highly insulated and are not short-circuited by the salt water. The same is the case in exploration of the deepest caves that have, as yet, been reached by man. There is no trouble in signalling to these caves, and transmission and reception is always remarkably easy.

When Marconi, therefore, now transmits ultra short waves beyond the horizon, you may be sure that the ground effect, or the so-called *ground-wave*, has a lot to do with it; and future experimental and scientific research into this field will no doubt affirm or reject the theory.

There is still a tremendous amount of experimental work to be done in the exploration of radio waves. It has always been a source of wonder to me why short-wave experimenters have not tried their hand at "underground reception." This means of reception was first tried out on a large scale by the late Dr. James Harris Rogers of Hyattsville, Md. All during the war, by means of buried insulated cables, which rested in trenches anywhere from 3 to 6 feet below the surface of the earth, Dr. Rogers was able to receive regularly European stations, with an almost total absence of static. He could even receive such stations when a thunderstorm was raging overhead!

For those experimenters who reside in the country, I would suggest that they try their hand at *underground reception* for short waves. The trick is rather simple; all that is necessary is to bury a rubber-covered wire in the ground, after digging a trench some 20 to 50 feet in length, and then cover the cable. This then is your new aerial. It should even be possible, today, to use a transposition aerial with two feeder lines running in each direction, and bring the twisted cable into the set. This would do two things: it would no doubt improve reception, and it would certainly do away with a lot of natural static as well as "man-made" static.

Here is an extremely interesting field for the experimenter who wishes to accomplish something worthwhile and who wishes to leave the beaten track. The editors would be pleased to hear from those who have made experiments in short-wave underground reception, and the results will, of course, be published for the benefit of all.

SHORT WAVE CRAFT IS PUBLISHED ON THE 5th OF EVERY MONTH

This is the November, 1933, Issue—Vol. IV, No. 7. The next Issue Comes out November 5th

Editorial and Advertising Offices - 96-98 Park Place, New York City

Acting to President Roosevelt, who soon will meet with Maxim Litvinoff, Soviet Commissar for Foreign Affairs.

TESLA CLAIMS MACHINE TO TAP COSMIC ENERGY

Continued from First Page.

years of laboratory search and scientific experimentation have been disposed of.

"I shall not announce the scientific principles of the discovery and describe the mechanical means I have devised for carrying it out, for the present. It is sufficient at this time to say that I have performed experiments and obtained results from which I am able to calculate what the mechanism may be expected to perform. Much, of course, remains to be accomplished, but it is work not necessarily of a creative kind; it can be done by many, and hence development to the point of actual operation may be enormously speeded up.

"WILL FLOW AT NIGHT."

"Night will not interrupt the flow of the new power supply. The disappearance of the sun below the horizon will not shut it off.

"The central-plant engine which will mechanize the cosmic energy and shoot it electrically to the other side of the world will operate on an entirely new principle, and will develop hundreds of thousands of horsepower.

"Any number of such central plants can be built, so there is no limit to the volume of power which it will be possible to develop for the turning of machinery—for the running of trains and automobiles, the driving of ships, the operating of factories, the myriad different motor tasks now performed by engines and machines which derive their power from the regular fuels of industry.

CITES "ABSURD REPORT."

"My statement of this discovery and invention, the result of nearly a third of a century of scientific toil, should serve to quiet the absurd report which has got about that I have perfected a portable engine which by extricating atomic energy will drive the largest steamship across the ocean. I have smashed probably trillions of atoms, and have definitely determined that they contain no available energy. The theory that they do is a futile dream. But the new cosmic power, the harnessing of the energy of the universe to the machinery of men, that is not a dream."

The world of science lets Dr.

office help refer to these columns.
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NOV. 1, 1933
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Page 10

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EDITORIAL PHONY
New York 4-8000

Device to Harness Cosmic Energy Claimed by Tesla

Predicts New Power Will Soon Displace All Present Fuels; Could Be Wirelessly.

Nikola Tesla, the celebrated physicist, recognized in the scientific world as the foremost living inventor,

announces that "at a date not distant" a new source of power will be available everywhere, displacing coal, oil, gas, and the other established fuels of industry. The inventor authorizes the statement that the mechanism is designed to revolutionize industry will be, when he presents it as his crowning achievement in the field of applied science, the result of thirty years of search and experimentation into and with the mysterious force which for want of a more precise terminology is called cosmic energy.

"PRESENT EVERYWHERE."
Dr. Tesla said: "This new power for the driving of the world's machinery will be derived from the energy which operates the universe, the cosmic energy, whose central source for the earth is the sun, and which is everywhere present in unlimited quantities. From the actual mechanical apparatus which I have developed for utilizing this energy, the power to drive engines and machines can be transmitted, either by wire or by my wireless system, as preferred, from central plants which may be located wherever desired, to any point on the globe, whether on land or sea.

"When the new power becomes commercially available, there will be no further necessity for depending on coal, oil, gas, or any other of the common fuels.

"NEED NOT BE DISTANT."
"Because no man can foretell with assurance how swiftly or how haggardly a revolutionizing scientific discovery and its mechanical complement will be commercially introduced, it is impossible for me to say how soon the new universal power will be in use. The time, however, need not be distant. The scientific uncertainties and mechanical difficulties with which I have dealt through thirty

Continued on Page 5, Column 1.

Board Approves Contract for Dam
OLYMPIC, Wash., Oct. 31 (AP).
Columbia Basin Commis-

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NIKOLA TESLA
See New Power in
Universal Use.

Tremendous NEW POWER soon to be unleashed

By Carol Bird

Nikola Tesla, Starting His 78th Year, Works on Revolutionary Power Project and Also Is Completing Process for Photographing Thought

PROVING his theory that a man's efficiency and accomplishments should increase and not diminish with advancing age, Nikola Tesla, inventor, physicist and one of the world's leading electrical technicians, enters his 78th year today, having spent on three or four great scientific projects.

Several of these inventions or discoveries will be looked upon as "miracles" by many people, for Mr. Tesla has long been a scientific giant ahead of his time, and whose advanced theories have already stamped him a "madman" and a wizard.

Just as people ridiculed Copernicus' theory of the planetary system, the un-
established Tesla's pronouncements, many years ago, regarding cosmic rays. The "madness" and the power—and the Tesla is both—are always con-
founded by the masses.

NIKOLA TESLA, tall, lean, with the face of an ascetic and deep-set eyes, whose expression denotes concentration on a course of work too big for most people's comprehension, partially de-
veloped a new and inexhaustible source of power he has discovered after years of research, revolutionizing modern
physical science. At the same time he
touched on his own reservoir of energy
which makes such monumental discov-
eries possible at his advanced age.

How does he tap both these deep
wells? What is the secret of his health,
keen mind, unusual vitality and mental
force at 77, the time of life when most
men are sitting in the sun with shaggy
over their knees or, alas! lying beneath
the soil?

Mr. Tesla is the father of the alter-
nating system of power transmission and
radio, the induction motor and Tesla
coil.

Asked about his startling new sci-
entific discovery, one of which concerns
the "photographing of thought," which
will, he maintains, bring about a revo-
lutionary social revolution, he said:

"My first and most important dis-
covery governs the harnessing of a new
source of power, hitherto unavailable, to
be developed through fundamentally
new machines of my invention.

"I am well prepared to dwell on the
details of the project, for they may be
classified before my lifetime can be
formally announced. I have worked on
the development of the underlying prin-
ciple for many years. From the prac-
tical point of view of the engineer en-
gaged in power development, the first
invention will be relatively very great,
but once a machine is installed it may
be depended on to function indefinitely
and the cost of operation will be next
nothing.

"My power generator will be of the
best kind—just a big mass of steel
and aluminum, comprising a disk
and rotating part, peculiarly
balanced. I am planning to develop
and transmit it to a distance
without any new machinery.

"The direct-current
will be employed if the
"great difficulties of in-
duction lines can be
solved at the same time of voice that a person occu-

"such a source of power obtainable
everywhere will solve many problems
with which the human race is con-
fronted. My alternating system has been
the means of harnessing 30,000,000 horse-
power of waterpower, and there are
projects now going on all over the world
which will eventually double that
amount. But, unfortunately, there is
not enough waterpower to satisfy great
needs, and everywhere inventors
and engineers are endeavoring to unlock
some additional store of energy."

WILL the smashing of the atom lead
to this new power energy? Let
Mr. Tesla answer:
"The public is naturally led to expect
a great revolution through the harness-
ing of atomic power, but that is an il-
lusion. Atomic energy is not available
for work. I operated many years
ago apparatus of a capacity of 2000
horsepower and treated of 10,000,000
volts with which trillions of atoms were
smashed in a fraction of a second. I
generated all sorts of static and de-
structive rays but found no trace of any
energy which should have been liber-
ated through the shattering of atomic
structure, according to theory. For the
last thirty years I have wasted my fel-
low scientists that there is nothing to
be expected in this field except some
specific effects due to changes in the
atomic structure which may have more
or less value."

Beyond adding that the new form of
energy which he has been investigating
many years would be available at any
place in the world in unlimited quan-
tities, and that the machinery for har-
nessing it would last more than 5000
years, Mr. Tesla would say little more
on the subject. Just when the power
will become available for practical pur-
poses he could not predict with any de-
gree of precision. In a few years, per-
haps, he ventured to say.

Mr. Tesla then talked of several other
projects on which he has been working
by way of relief from too much concen-
tration on the main piece of work. He
described one of his other interests, one
which is dramatic, which stirs the imagi-
nation and which, doubtless, will sound
too revolutionary to most people. But it
must not be forgotten, as Mr. Tesla
points out, that the ideas of television
and radio and airplanes were scoffed at
in their infancy.

"I expect to photograph thought,"
announced Mr. Tesla calmly, in the
same tone of voice that a person occu-

pled with some trivial things in the
scheme of life might announce that it
was going to rain.

Continued Mr. Tesla: "In 1927, while
engaged in certain investigations, I be-
came convinced that a definite image
formed in thought must, by reflex ac-
tion, produce a corresponding image on
the retina, which might possibly be read
by suitable apparatus. This brought me
to my system of television, which I an-
nounced at that time.

"My idea was to employ an artificial
retina receiving the image of the object
seen, an optic nerve and another such
retina at the place of reproduction.
These two retinas were to be constructed
somewhat after the fashion of a electro-
cardiograph, with many separate plate sec-
tions, and the so-called optic nerve was
nothing more than a part of the cord."

"An invention of mine enables me to
transmit simultaneously, and without
any interference, whatever hundreds
of thousands of distinct impulses through
the ground just as though I had many
separate wires. I did not contemplate
using any moving part—a scanning
apparatus or a cathode ray, which is a
sort of motor device, the use of which
I suggested in one of my lectures of that
period."

"Now if it be true that a thought re-
flects an image on the retina, it is a
mere question of illuminating the same
properly and taking photographs, and
then using the ordinary methods which
are available to project the image on a
screen."

"If this can be done successfully, then
the objects imagined by a person would
be clearly reflected on the screen as they
are formed, and in this way every
thought of the individual could be read.
Our minds would then, indeed, be like
open books."

BESIDES his discoveries concerning
the harnessing of the new energy,
television and thought photography, Mr.
Tesla is working to produce a type of
radio transmitter which will insure the
absolute security in wireless communica-
tion regardless of the number of sub-
scribers, and he is developing some im-
portant discoveries in molecular physics
which will revolutionize the science of
metallurgy and greatly improve metals.

After a discussion of his new televi-
sion findings, Mr. Tesla turned to the
subject of his personal source of en-
ergy and what he considers the real
values of life.

"One of the most fundamental and
important things in life is the harnessing
of the new energy, television and thought
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ues of life.



Nikola Tesla, dean of American inventors, with numerous triumphs in electrical engineering behind him, as he looked on the 77th birth-
day, which he recently celebrated

also one of the saddest facts in human
life is well brought out in a French
proverb which, freely translated, means:
"If Youth had the knowledge and age
the power of doing," said Mr. Tesla.

"Our condition of body and mind to
old age is purely a certificate of how
we have spent our youth. The secret
of my own strength and vitality today
is that, for my youth I did what you
might call a virtuous life."

"I have never dissipated. When I was
a young man I understood well the im-
portance of that old French proverb
although I think that I had even heard
it then. But I seemed to have a clear
understanding while still young that
I must control my passions and appet-
ites if I wished to make some of my
difficulties and draw."

"So with this in view, quite early in
life I set about disciplining myself,
planning out a program of living for
what I considered the sake and worth-
while life."

"Since I love my work above all
things, it is only natural that I should
wish to continue it until I die. I want
no vacation—no surprise from my
labors. If people would select a life
work compatible with their tempera-
ments the sum total of happiness would
be immeasurably increased in the world."

"Many are saddened and depressed
by the brevity of life. 'What is the
use of attempting to accomplish any-
thing?' they say. 'Life is so short. We
may never live to see the completion
of the task.' Well, people could prolong
their lives considerably if they would
but make the effort. Human beings do
so many things that pave the way to
an early grave."

"First of all, we eat too much, but
this we have all heard said often be-
fore. And we eat the wrong kinds of
food and drink the wrong kind of
liquids. Most of the harm is done by
overeating and underexercising, which
brings about toxic conditions in the body
and makes it impossible for the system
to throw off the accumulated material."

"My regime for the good life and my
diet: Well, for one thing, I drink plenty
of milk and water."

"Why overburden the body that
never rest? I eat but two meals a day,
and I avoid all acid-producing foods.
Almost everybody eats too many peas
and beans and other foods containing
uric acid and other poisons. I practice
liberality of fresh vegetables. I eat a
meal sparingly, and rarely. Fish is re-
garded as the brain food, but has a very
great deal of phosphorus. And it is so
far the worst enemy to fight off in old
age."

"Fats are essential, and should be
eaten at least once a day. They contain
valuable mineral salts and are nutri-
tious."

"I believe in plenty of exercise. I walk
eight or ten miles every day, and never
take a cab or other conveyance when
I have the time to use my legs. I
also exercise in my bath daily, for I
think this is of great importance. I
take a warm bath, followed by a pro-
longed cold shower."

"Sleep! I scarcely ever sleep. I come
of a stocky family, but it is so hard
for the poor sleeper. I expect to match
the records of my ancestors and live
to be at least 100."

"MY SLEEPlessness does not
hurt me. Sometimes I doze for
an hour or so. Occasionally, however,
once in a few months, I may sleep for
four or five hours. Then I awaken vir-
tually charged with energy, like a bat-
tery. Nothing can stop me after such
a night. I feel great strength then.
There is no doubt about it but that
sleep is a restorer, a vitalizer, that it
increases energy. But on the other
hand, I do not think it is essential to
work well-being, particularly if one is
habitually a poor sleeper."

"Today, at 77, as a result of well-
regulated life, I am enjoying robust
health. I never felt better in my
life. I am energetic, strong, in full pos-
session of all my mental faculties. In
my opinion, I am younger than the aver-
age man of my age. I have today, and
I have today, and I have today, in
solving my problems I use but a small
part of the energy I possess, for I have
learned how to conserve it. Because of
this discipline in my life, I am able to
live through the years, my tastes are much
higher. Contrary to general belief,
work comes rather for older people, for
they are in good health, because they
have learned through years of practice
how to arrive at a given place by the
shortest path."

"I expect to photograph
thought," says Mr. Tesla.
"If this can be done success-
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Tremendous NEW POWER soon to be unleashed

By Carol Bird

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Mr. Tesla is the father of the alternating system of power transmission and radio, the induction motor and Tesla coil.

Asked about his startling new scientific discoveries, one of which concerns the "photographing of thought" which will be maintaining, being about a tremendous mental revolution, he said:

"My first and most important discovery concerns the harnessing of a new source of power, hitherto unavailable, to be developed through fundamentally novel machines of my invention.

"I am not yet prepared to dwell on the details of the project, for they must be checked before my findings can be formally announced. I have worked on the development of the underlying principles for many years. From the practical point of view of the engineer engaged in power development, the first investment will be relatively very great, but once a machine is installed it may be depended on to function indefinitely and the cost of operation will be next to nothing.

"My power controller will be of the kind—just a big mass of steel, and aluminum, comprising a rotating part, peculiarly shaped, I am planning to develop a motor system now underway. The direct-current will be employed if the 'valuable difficulties of transmission lines can be

Nikola Tesla, Starting His 78th Year, Works on Revolutionary Power Project and Also Is Completing Process for Photographing Thought

"Such a source of power obtainable everywhere will solve many problems with which the human race is confronted. My alternating system has been the means of harnessing 30,000,000 horsepower of waterpower, and there are projects now going on all over the world which will eventually double that amount. But, unfortunately, there is not enough waterpower to satisfy present needs, and everywhere inventors and engineers are endeavoring to unlock some additional store of energy."

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Beyond adding that the new form of energy which he has been investigating many years would be available at any place in the world in unlimited quantities, and that the machinery for harnessing it would last more than 500 years, Mr. Tesla would say little more on the subject. Just when the power will become available for practical purposes he could not predict with any degree of precision. In a few years, perhaps, he ventured to say.

Mr. Tesla here talked of several other projects on which he has been working by way of relief from too much concentration on the main piece of work. He described one of his other interests, one highly dramatic, which stirs the imagination and which, doubtless, will sound too revolutionary to most people. But it must not be forgotten, as Mr. Tesla points out, that the ideas of television and radio and airplane were scoffed at in their infancy.

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pled with some trivial things in the scheme of life might announce that it was going to rain.

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"My idea was to employ an artificial retina receiving the image of the object seen, an 'optic nerve' and another such retina at the place of reproduction. These two retinas were to be controlled somewhat after the fashion of a checkerboard, with many separate little sections, and the so-called optic nerve was nothing more than a part of the circuit.

"An invention of mine enables me to transmit simultaneously, and without any interference whatsoever, hundreds of thousands of distinct impulses through the ground just as though I had no many separate wires. I did not contemplate using any moving part—a scanning apparatus or a cathode ray, which is a sort of moving device, the use of which I suggested in one of my lectures of that period.

"Now if it be true that a thought reflects an image on the retina, it is a mere question of illuminating the same properly and taking photographs, and then using the ordinary methods which are available to project the image on a screen.

"If this can be done successfully, then the objects imagined by a person would be clearly reflected on the screen as they are formed, and in this way every thought of the individual could be read. Our minds would then, indeed, be like open books."

BESIDES his discoveries concerning the harnessing of the new energy, television and thought photography, Mr. Tesla is working to produce a type of radio transmitter which will insure the strictest privacy in wireless communication regardless of the number of subscribers, and he is developing some important discoveries in molecular physics which will revolutionize the science of metallurgy and greatly improve metals.

After a discussion of his new scientific findings, Mr. Tesla turned to the subject of his personal source of energy and what he considers the real values of life.

"One of the most fundamental and



Nikola Tesla, dean of American inventors, with numerous triumphs in electrical engineering behind him, as he looks up his 77th birthday, which he recently celebrated

also one of the saddest facts in human life is well brought out in a French proverb which freely translated, means: 'If Youth had the knowledge and Age the power of doing,' said Mr. Tesla. "Our condition of body and mind in old age is surely a certificate of how we have spent our youth. The secret of my own strength and vitality today is that in my youth I led what you might call a virtuous life."

"I have never complained. When I was a young man I understood well the significance of that old French proverb, although I doubt that I had even heard it then. But I seemed to have a clear understanding while still young that I must control my passions and appetites if I wanted to make some of my dreams come true.

"So with this in view, quite early in life I set about disciplining myself. I planned a program of living for

what I considered the sane and worthwhile life.

"Since I love my work above all things, it is only natural that I should wish to continue it until I die. I want no vacation—no respite from my labors. If people would select a life work compatible with their temperament, the sum total of happiness would be immeasurably increased in the world.

"Many are adduced and depressed by the brevity of life. 'What is the use of attempting to accomplish anything?' they say. 'Life is so short. We may never live to see the completion of the task.' Well, people could prolong their lives considerably if they would but make the effort. Human beings do so many things that pave the way to an early grave.

"First of all, we eat too much, but this we have all heard said often before. And we eat the wrong kinds of

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foods and drink the wrong kind of liquids. Most of the harm is done by overeating and underexercising, which bring about toxic conditions in the body and make it impossible for the system to throw off the accumulated poisons.

"My regime for the good life and my diet? Well, for one thing, I stock plenty of milk and water.

"Why overeat? The bodies that serve us? I eat but two meals a day and I avoid all acid-producing foods. Almost everybody eats too many peas and beans and other foods containing uric acid and other poisons. I parable liberally of fresh vegetables, fish, no meat sparingly, and rarely. Fish is regarded as first brain food, but has a very strong acid reaction, as it contains a great deal of phosphorus. Another is to be the worst enemy to take off in old age.

"Fats are splendid, and should be eaten at least once a day. They contain valuable mineral salts and are neutralizing."

"I believe in plenty of exercise. I walk eight or ten miles every day, and never take a cab or other conveyance when I have the time to use legpower. I also exercise in my bath daily, for I think this is of great importance. I take a warm bath, followed by a protracted cold shower.

"Sleep? I scarcely ever sleep. I come for his poor sleepers. I expect to match the records of my ancestors and live to be at least 100.

"MY SLEEPLESSNESS does not at all worry me. Sometimes I doze for an hour or so. Occasionally, however, once in a few months, I may sleep for four or five hours. Then I awaken virtually charged with energy like a battery. Nothing can stop me after such a night. I feel great strength but that sleep is a restorer, that it increases energy. But on the other hand, I do not think it is essential to one's well-being, particularly if one is habitually a poor sleeper.

"Today, at 77, as a result of well-regulated life, sleeplessness notwithstanding, I have an excellent certificate of health. I never felt better in my life. I am energetic, strong, in full possession of all my mental faculties. In my prime I did not possess the energy I have today. And what is more, in solving my problems I use but a small part of the energy I possess, for I have learned how to conserve it. Because of my experience and knowledge, gained through the years, my tasks are much lighter. Contrary to popular belief, work comes easier for older people if they are in good health, because they have learned through years of practice how to arrive at a given object by the shortest path."

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Great scientific projects.
Several of these inventions or discoveries will be looked upon as "miracles" by many people, for Mr. Tesla has long been a scientist years ahead of his time, one whose advanced theories have alternately stamped him a "madman" and a wizard.

Just as people ridiculed Copernicus' theory of the planetary system, the unenlightened jeered Tesla's pronouncement, years ago, regarding cosmic rays. The pathfinder and the pioneer—and Mr. Tesla is both—are always condemned by the masses.

NIKOLA TESLA, tall, lean, with the face of an ascetic and deep-set eyes, whose expression denotes concentration on a canvas of work too big for most people's comprehension, partially described a new and inexhaustible source of power he has discovered after years of research, revolutionizing modern physical science. At the same time he touched on his own reservoir of energy which makes such monumental discoveries possible at his advanced age.

How does he tap both these deep wells? What is the secret of fine health, keen mind, unusual vitality and mental force at 77, the time of life when most men are sitting in the sun with shawls over their knees or, alas! lying beneath the sod?

Mr. Tesla is the father of the alternating system of power transmission and radio, the induction motor and Tesla coil.

Asked about his startling new scientific discoveries, one of which concerns the "photographing of thought," which will, he maintains, bring about a tremendous social revolution, he said:

"My first and most important discovery concerns the harnessing of a new source of power, hitherto unavailable, to be developed through fundamentally novel machines of my invention.

"I am not yet prepared to dwell on the details of the project, for they must be checked before my findings can be formally announced. I have worked on the development of the underlying principles for many years. From the practical point of view of the engineer engaged in power development, the first investment will be relatively very great, but once a machine is installed it may be depended on to function indefinitely, and the cost of operation will be next to nothing.

"My power generator will be of the simplest kind—just a big mass of steel, copper and aluminum, comprising a stationary and rotating part, peculiarly assembled. I am planning to develop electricity and transmit it to a distance by my alternating system now universally established. The direct current system could also be employed if the heretofore insuperable difficulties of insulating the transmission lines can be overcome.

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"One of the most fundamental and also one of the saddest facts in human life is well brought out in a French proverb which, freely translated, means: 'If youth had the knowledge and age the power of doing,'" said Mr. Tesla. "Our condition of body and mind in old age is merely a certificate of how we have spent our youth. The secret of my own strength and vitality today is that in my youth I led what you might call a virtuous life."

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still young that I must control my passions and appetites if I wanted to make some of my dreams come true.

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Nikola Tesla, d
in electrical eng

Tesla seems on the verge of something stupendous! — morris

SUNDAY, SEPTEMBER 10, 1933.

KANSAS CITY JOURNAL-POST.

PHONE MAIN 4000

Tremendous NEW POWER soon to be unleashed



By CAROL BIRD.
PROVING his theory that a man's efficiency and accomplishments should increase, and not diminish with middle age, Nikola Tesla, the world's greatest electrical inventor, has engaged his seventy-eighth year in a project which he believes will be the greatest scientific project of the century.

By the face of an active and eager eye, whose expression is one of intense concentration in a canvas of the face, Nikola Tesla, the world's greatest electrical inventor, has engaged his seventy-eighth year in a project which he believes will be the greatest scientific project of the century.

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Nikola Tesla, Starting His 78th Year, Works on Revolutionary Power Project and Also Is Completing Process for Photographing Thought

Now going on all over the world, the idea was to create an artificial light which would be the most powerful and efficient of all. Tesla's project is not enough, however, to satisfy the world's demand for power. Tesla is now working on a project which he believes will be the greatest scientific project of the century.



Nikola Tesla, one of America's greatest inventors, with numerous triumphs in electrical engineering before him, as he looked on his 77th birthday, which he recently celebrated.

... respect to photographing thought," said Mr. Tesla. "If the can be done successfully, then the objects appearing in a person's mind would be clearly reflected on the screen as they are formed. Our minds would thus, indeed, be like open books."

Journal-Post Pattern



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MANY NEW ROUTES OPENED ACROSS STATE

Fortunately for the people of Kansas City and the State, the new routes opened across the State will be a great benefit to the people. The new routes will be a great benefit to the people.

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PROVING his theory that a man's efficiency and accomplishments should increase, and not diminish with mellow age, Nikola Tesla, inventor, physicist and one of the world's leading electrical technicians, engages his seventy-eighth year fully engaged on three- or four great scientific projects.
Several of these inventions or discoveries will be looked upon as "miracles" by many people, for Mr. Tesla has long been a scientist

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creases energy. But as I have said, I do not think it is one's will that counts. One is habitually a poor or a good person. Today, at 77, a regular, regulated life, sleepless, withstanding, I have a certificate of health. I believe in my life. I am strong, in full possession of my faculties. In my old age, I do not possess the same energy I possess today. And what is more, my problems I can solve. I have learned how to control the energy I possess. I have gained through the use of my experience, general belief, work, and for other people. It is my health, because they are through years of great stress at a given place and path."

MANY NEW RO OPENED ACRO

Fortunately for the Kansas City and the Chicago world's tremendous progress state highway department in the construction of highways has the latest many increasing routes. Thousands of tons of steel and concrete are being poured in the state to build the most cities of great interest, have been in the path of the for the Chicago the East.

Newly paved shorter routes make it possible to visit the great interest the successful.

A newly opened route from far Bonville, Colorado, has within 50 miles.

People travel with the great road, travel on blue grass, grain, through with the great first book through history the story of the location of the ment to this through the world in the Mississippi. V river, the Mississippi river.

An alternate City would through both fair grounds. Another comes from the Bagwell, due Gravel, the water lake through the the above.

Journal-Post Photo

NEW POWER

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MANY NEW ROUTES OPENED ACROSS STATE

Fortunately for the people of Kansas City and the Southwest in this Chicago world's fair year, the tremendous progress made by the state highway department of Missouri in the construction of Missouri highways has opened up to the tourist many new and vastly interesting routes across Missouri. Thousands of tourists from the West and Southwest are, this year, crossing Missouri who have never crossed the state before. Many Missouri cities of great historical interest have been placed directly in the path of the people bound for the Chicago world's fair and the East.

Newly paved highways over shorter routes make it easy for the tourist to visit numerous places of great interest that were heretofore inaccessible.

A newly opened paved route, Kansas City to Chicago, makes it possible to drive an automobile the entire distance in one day, as this route from Kansas City through Bonville, Columbia, Mexico and Louisiana has brought Chicago within 500 miles of Kansas City.

People traveling this route can visit the great University of Missouri, travel over the great upland, blue grass prairies of central Missouri, through Audrain county, with the greatest clay mines and fire brick plants in the world; through historical Bowling Green, the home of Champ Clark and the location of the magnificent monument to this great statesman; through the greatest nurseries in the world in Pike county and across three of the great rivers of the Mississippi valley, the Missouri river, the Mississippi river and the Illinois river.

An alternative route from Kansas City would be over U. S. 50 through Sedalia, the Missouri state fair grounds, to Jefferson City.

Another newly opened route across Missouri from the Southwest comes through Springfield and the famous Ozark hills, over the great Bagwell dam and the Lake of the Ozarks, the largest artificial fresh water lake in the world and on through the state capital to join the above route at Kingdom City.

Journal-Post Pattern



N.Y. Sun

July 10, 1933

TESLA CERTAIN OF HIS NEW POWER

Inventor Says Only Details Remain to Be Checked.

The closing of experiments which reveal the availability of a hitherto untapped reservoir of energy, to be developed through simple machines which will last 500 years, was announced today by Nikola Tesla, inventor and physicist. Mr. Tesla chose his seventy-seventh birthday for his announcement, which was in reality an amplification of an announcement first made on his seventy-fifth.

Even now, however, details remain to be checked before the findings may be published and the source of the power revealed. Mr. Tesla has, however, completed and checked the basic experiments, he says, and feels able to announce as a certainty what he would indicate two years ago as only a probability.

He characterized his discovery as "so basic that it will undo the Einstein theory of relativity." "The machines will be simpler than any machines ever invented for the production of power." He added that the initial costs of the machines would be relatively large, but that they would be, for the practical purposes of short-lived man, everlasting. After installation, the machines will cost almost nothing for operation, he added. "There will be unlimited power almost for the asking."

He said, however, that he expected to be considered crazy. "They called me crazy in 1896 when I announced the discovery of cosmic rays," he said. "Again and again they jeered when I discovered something new and then years later saw that I was right."

Mr. Tesla at one time worked with Thomas A. Edison. He is accepted as one of the world's outstanding electrical technicians, who had contributed much of the research on which the practical application of radio is based.

Drowns in Midstream As Companions Leave

ST. LOUIS, July 10 (A.P.)—Efforts of ten men failed to save Arthur Bayles, 31, from drowning in the Mississippi River yesterday. Bayles and a party of friends arrived at a beach on the river yesterday in automobiles. Bayles expressed a desire to go in swimming. Friends tried to dissuade him, but he insisted on going. He was seen struggling in the water until he disappeared. His companions, he leaped out and struck out for shore. As he near shore, he was seen from view in the water, friends standing by.

Breaking away from his companions, he leaped out and struck out for shore. As he near shore, he was seen from view in the water, friends standing by.

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1/3 off

best
and
no
one
can
beat
it



To the Ladies!



By

PRINCESS ALEXANDRA KROPOTKIN

linguist, friend of the famous in Europe, and descendant of the first czar of Russia

(Reading time: 4 minutes 45 seconds.)

OUT on the sidewalk on sunny days, in front of a commercial hotel near the Pennsylvania Station, you can see a gaunt old gentleman walking up and down. He is head and shoulders above the New York crowd. He is a giant.

Dr. Nikola Tesla is a giant in this town and time. During the greater part of this the greatest century in the inventive life of mankind, Dr. Tesla has worked and discovered and thought among the foremost.



Nikola Tesla

He invented the arc light, developed the transmission of electric power without wires. He worked with Edison. His experiments in charging the human body with high-frequency currents (under certain specific conditions) have proved of inestimable value in medical practice.

"Some day," said Dr. Tesla, "we will all be using these so-called 'electrical baths' to cleanse our bodies of dust and dirt."

As I talked with Tesla his thoughts swept back over the centuries to man's first awareness of electricity.

"Moses had an instrument for storing electricity," Tesla told me. "It came from the Egyptians, and it generated electricity from the friction of the wind blowing against curtains of silk."

We talked of Dr. Tesla's childhood; of his Serbian parents; of Smiljan—Place of Flowers—where he was born.

The vividness of his memory amazed me. Dr. Tesla remembers everything he ever has done or seen or heard throughout his long and eventful life. Incidents which occurred when he was two years old are as clear to him as those of yesterday, and he remembers word for word the text of books read in childhood.

Vision, a tremendous capacity for observation, intense interest in all the manifestations of creation—these are Dr. Tesla's, and with them a grave and courtly kindness.

AMONG the new books I like particularly Martha Ostenso's *Prologue to Love*. The rugged northern country of British Columbia interested me and the strength of the story is unusual, I thought. (Published by Dodd, Mead.)

SOME days ago a determined lady—she is socially prominent and very active in charity work—attempted to prove to me that everyone was much happier in the Middle Ages than most of us are today.

Since I talked with the determined lady I have come upon some rules that were in force at a rich English monastery of medieval times.

"A bath should by no means be refused to a body when compelled thereto by the needs of ill health. . . .

Should a brother wish for one when not advantageous, his desire is not to be gratified."

That was one of the rules. I wonder how the determined lady would like being compelled to forgo the bathing privileges of our kindly civilization? I wonder how she would like to wear the towering hair arrangement of the eighteenth century—and take her hair down only once a month?

Not for me! I prefer to live in 1932.

DO you remember the days when children were encouraged to collect flowers, ferns, and leaves, to press them and save them, and to pin them on sheets of thick paper with a neat description of each specimen written in a corner?

These childhood herbariums were beautiful and instructive. I had, I remember, a fine collection of dried seaweeds. Our trend today is all toward professionalism. Collecting leaves and plants is too often dismissed as leading nowhere.

Yet the road that seems to wander nowhere has a way, at times, of leading to some unexpected haven. For example:

Fifty women who learned how to preserve and classify plants when they were girls have just been given steady jobs at the New York Botanical Garden.

THE mole has burrowed its way back into favor. Moleskin is the fur of the year for our new "transformation" sets.

Wonderful things, these sets, and I am told that Scotch pelts are the best of the moleskins.

I saw one set consisting of a medium-sized moleskin collar with two fur scarf ends that could be attached to the collar or clipped on to a striped jersey scarf, and a small cape to be used with the collar or without. These combinations served in turn on two suits, two coats, and a cloth dress. I'll bet that set was made of Scotch mole. No other mole could inspire such thrills!

I MET a tall blonde at a recent tea party. I didn't hear her name. I judged her to be about thirty-five. "Mutton," said I to myself, "dressed as lamb."

A pancake hat perched on her curls—the way kids put their hats on sometimes when they are being funny. Her baby-blue dress clung too intimately to her figure, and she wore a large cheap-looking ornament at her throat—of imitation diamonds, I thought.

Half an hour later I learned her name. She was a much advertised beauty, a woman of great wealth. I realized that her diamonds were real but so ostentatious that they looked false.

And her actual age, I knew, was twenty-five, not thirty-five.

With just a little dignity and taste she would have looked a youthful twenty-five. Her foolish pursuit of schoolgirl "kiddishness" added ten years to her appearance.

Light

Former President G

PEOPLE in this country, in the economic situation, business do not seem to be much better off than Cuba, as a case in point, is far worse off than the unresourceful government of the summer of last year at Pinar del Rio; the soundest elements to power of former

General Menocal, during his administration, be that admirable business man of a high degree of vision, are firmly of the opinion that the commercial losses of the last few years. The government and his policy, apparently, is too late, Cuba will be able to overcome difficulties, handicaps. It appears to persons that she will not

Stimulus a

NIKOLA TESLA, the inventor of electricity, has a fine feel, will eventually be comparable to the fluid which so much of civilization these days is made of. The details of his discovery, the details of his work, is coming to the press, is coming to the press, is coming to the press.

Dr. Tesla, in dealing with a number of tuning forks. He thought where all the other tuning forks of the smaller tuning forks into a master fork into a master fork vigorously and responded to the first room

INVENTION IN RETROSPECT.

In 1913 The Scientific American held a contest open to the world to determine what were "the ten greatest inventions of our time." Commercial importance was to be the criterion of greatness, and by "our time" the preceding twenty-five years was meant. One of those who participated was Mr. WILLIAM J. WYMAN, who, as a Patent Office examiner, was in a peculiarly favorable position to appraise inventions. In The Journal of the Patent Office Society Mr. WYMAN now looks back at his list of nearly two decades ago and judges himself.

The ten inventions selected by him in 1913 were the electric furnace which reduced the price of aluminum from \$12 to 25 cents a pound; the steam turbine, which even then was driving ships at unprecedented speeds and generating energy at unprecedented low costs; the automobile, which was changing the habits of the American people and restoring the highway to its old social and economic importance; moving pictures; the airplane, which realized a dream as old as man; wireless communication, which was intangibly linking ships to their ports and colonies to their mother countries; the cyanide process, which trebled the output of gold; the induction motor of TESLA, which made it possible for alternating current, transmitted over long dis-

ness Survey, October, 1

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Light on the Cuban Situation

Former President General Mario G. Menocal Stresses Short-Sighted Policy of Present Administration

PEOPLE in this country who chronically complain of the economic situation and sub-normal conditions of business do not seem to realize that, in actual fact, we are much better off than the rest of the world.

Cuba, as a case in point, near enough for Americans to study, is far worse off than we are. Due to a short-sighted and unresourceful government, Cuba has drifted into a serious economic crisis. Cuba had her chance in the latter part of the summer of last year, but lost it on the 13th of August at Pinar del Rio; although in the opinion of experts the soundest elements in the nation favored the return to power of former President General Mario G. Menocal.

General Menocal, during his administration, proved himself to be that admirable combination in a chief executive, —a business man of a high order as well as a political leader gifted with vision and judgment. Qualified observers are firmly of the opinion that he could have saved Cuba the commercial losses which she has sustained during the past few years. The best minds of the country favored him and his policy and still do; but the reigning machine, apparently, is too strong to be broken as yet. Whether Cuba will be able to work herself out of her present difficulties, handicapped as she is, remains to be seen. It appears to persons in a position to speak with authority that she will not be able to do so. At any rate,

her return to comparative prosperity can be expedited only through a change of administration.

The short-sightedness characteristic of the present government manifested itself recently in its advocacy of a grant of a 40-year monopoly on the sale of oil and gasoline in Cuba in exchange for the payment of Cuba's national debt. General Menocal opposes such a scheme on the ground that it is unconstitutional and would be a bad business deal. His intimate knowledge of the resources of his country enables him to estimate the probable value to the government of the oil deposits for the next 40 years at \$300,000,000, whereas the national debt is only \$200,000,000. Thus the Cuban Congress is detected in the act of throwing away the huge sum of \$100,000,000 merely as a political move designed to appeal to the more short-sighted members of the body politic.

"No future government of Cuba would recognize such an agreement," General Menocal declared, "but would, doubtless, annul such a monopoly." The tax on gasoline, General Menocal observed, yields about \$12,000,000 a year. General Menocal said that Oscar Cintas, who is soon to be Cuban Ambassador to the United States, had been in Wall Street for several days trying to negotiate the oil monopoly agreement.

Such mis-steps as this would be avoided under an administration concerned with the true welfare of the nation and not solely with questions of political expediency.

Stimulus and Response

DR. NIKOLA TESLA, who contributed the basic inventions which made possible the commercial development of electricity, has hit upon another discovery which, we feel, will eventually benefit the human race in a manner comparable to the benefits derived from the mysterious fluid which so thoroughly permeates all centers of civilization these days.

This discovery, the details of which were only recently released to the press, is comprised in a simple experiment which shows the mechanical nature of the function of memory. Dr. Tesla, in demonstrating this experiment, arranged a number of tuning-forks at equal distances around a master fork. He then activated the master fork to the point where all the other forks responded to it. He selected one of the smaller forks at random, and taking it and the master fork into another room, he excited the master fork vigorously and for a long time, while the selected fork responded to it. He then returned with both forks to the first room and, placing the two back in their respective former positions, began gently exciting the master fork until only one fork responded—and that was the one he had chosen at random and treated to prolonged exposure to the vibratory waves of the master fork.

This experiment proves that the function of memory is mechanical and it opens avenues of investigation which seem to us to lead straight to the heart of the question of evolutionary processes in nature. The conditioning of an organism or of insensate atomic structures of any kind to repeated impressions obviously brings about some mys-

"Speak the Language Trippingly on the Tongue"

Try this on your ukulele: A bitter biting bittern bit a better biting bittern, and the bitten bittern bit the bitter bittern back, and the bitter bittern bitten by the better biting bittern is now a bitter biting bittern bitten back.—U. S. S. Breeze Kidder.

Tight-Wads

It's little use! New Jersey elected an "economy Legislature," and then the members voted themselves \$51 de luxe swivel chairs and \$24 card tables.—*Minneapolis Journal*.

terious change in that organism or structure which facilitates its absorption of repeated impressions of the same nature and renders it more susceptible to them. This law has long been recognized by physicists as it is borne out in the evolutionary processes among organic bodies, but the demonstration that it exists in insensate matter not only proves its existence in the former, but offers a readily accessible and demonstrable avenue for experimentation and research.

The human race owes Dr. Tesla a debt from which it will never be absolved, already; but we feel that the simple experiment which he has completed will result in immeasurably increasing that debt, and we hope that his keen intelligence is brought to bear on the continued investigation of the phenomena which it has opened up.

Value of Certain 'Super'

Pioneer Radio Engineer Gives Views on Power

Soon Tesla Says Wireless Waves Are Not Electromagnetic, but Sound in Nature

Holds Space Not Curved

Predicts Power Transmission to Other Planets

By Nikola Tesla

The assumption of the Maxwellian ether was thought necessary to explain the propagation of light by transverse vibrations, which can only occur in a solid. So fascinating was this theory that even at present it has many supporters, despite the manifest impossibility of a medium, perfectly mobile and tenuous to a degree inconceivable, and yet extremely rigid, like steel. As a result some illusory ideas have been formed and various phenomena erroneously interpreted. The so-called Hertz waves are still considered a reality proving that light is electrical in its nature, and also that the ether is capable of transmitting transverse vibration of frequencies however low. This view has become untenable since I showed that the universal medium is a gaseous body in which only longitudinal pulses can be propagated, involving alternating compressions and expansions similar to those produced by sound waves in the air. Thus, a wireless transmitter does not emit Hertz waves which are a myth, but sound waves in the ether, behaving in every respect like those in the air, except that, owing to the great elastic force and extremely small density of the medium, their speed is that of light.

Suggested Short Waves Early

Since waves of this kind are all the more penetrating, the shorter they are, I have urged the experts engaged in the commercial application of the wireless art to employ very short waves, but for a long time my suggestions were not heeded. Eventually, though, this was done, and gradually the wave lengths were reduced to but a few meters. Invariably it was found that these waves, just as those in the air, follow the curvature of the earth and bend around obstacles, a peculiarity exhibited to a much lesser degree by transverse vibrations in a solid. Recently, however, ultrashort waves have been experimented with and the fact that they also have the same property was hailed as a great discovery, offering the stupendous promise to make wireless transmission infinitely simpler and cheaper.

It is of interest to know what wireless experts have expected, knowing that waves a few meters long are transmitted clear to the antipodes. Is there any reason that they would behave radically different when their length is reduced to about half of one meter?

Waves Go Around World

As the general knowledge of this subject seems very limited, I may state that even waves only one or two millimeters long, which I produced thirty-three years ago, provided that they carry sufficient energy, can be transmitted around the globe. This is not so much due to refraction and reflection as to the properties of a gaseous medium and certain peculiar action which I shall explain some time in the future. At present it may be

New Columbia Extension Traces History of

850 Subjects Included in Division Evening Students May Obtain Degree in Accounting Department

A six-year course in accounting which will enable evening students to obtain a bachelor's degree in place of the certificate now issued to the graduates of the four-year course will be inaugurated this fall in the University Extension at Columbia. Professor James C. Egbert, director, announced yesterday.

The change is being made, according to Professor Egbert, to meet with the new requirement of New York State law that after January 1, 1933, "every candidate for examination as a certified public accountant shall present evidence that he has satisfactorily completed the course of study in a college or school of accountancy registered by the department as maintaining a satisfactory standard." The 1932-33 program of the Columbia extension which will enter its twenty-second year as a university undertaking, includes 850 courses, among which will be a series of studies in the history of philosophy based on the "public courses" of the universities of France, to be under the supervision of the leading members of the Columbia faculty of philosophy.

During the coming year, students will be enabled to follow their various lines of study at the Seth Low Junior

so-called three-electrode tubes. This invention has been credited to others, but as a matter of fact, it was brought out by me in 1892, the principle being described and illustrated in my lecture before the Franklin Institute and National Electric Light Association. In my original device I put around the incandescent filament a conducting member, which I called a "sleeve." This device is connected to a wire leading outside of the bulb and serves to modify the stream of particles projected from the filament according to the charge imparted to it. In this manner a new kind of detector, rectifier and amplifier was provided. Many forms of tubes on this principle were constructed by me and various interesting effects obtained by their means shown to visitors in my laboratory from 1893 to 1899, when I undertook the erection of an experimental world-system wireless plant at Colorado Springs.

During the last thirty-two years these tubes have been made veritable marvels of mechanical perfection, but while helpful in many ways, they have drawn the experts away from the simpler and much superior arrangement which I attempted to introduce in 1901. My plans involved the use of a highly effective and efficient transmitter conveying to any receiver at whatever distance, a relatively large amount of energy. The receiver is itself a device of elementary simplicity paring of the characteristics of the ear, except that it is immensely more sensitive. In such a system resonant amplification is the only one necessary and the selectivity is so great that any desired number of separate channels can be provided without going to waves shorter than a few meters.

For this reason, and because of other shortcomings, I do not attach much importance to the employment of waves which are now being experimented with. Besides, I am contemplating the practical use of another principle, which I have discovered and which is almost unutilized in the number of channels and in the energy three-electrode tubes. This invention

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It might be inferred that I am alluding to the curvature of space supposed to exist according to the teachings of relativity, but nothing could be further from my mind. I hold that space cannot be curved, for the simple reason that it can have no properties. It might as well be said that God has properties. He has not, but only attributes and these are of our own making. Of properties we can only speak when dealing with matter filling the space. To say that in the presence of large bodies space becomes curved, is equivalent to stating that something can act upon nothing. I, for one, refuse to subscribe to such a view.

Need Radio Channels

The chief object of employing very short waves is to provide an increased number of channels required to satisfy the ever-growing demand for wireless appliances. But this is only because the transmitting and receiving apparatus, as generally employed, is ill-conceived and not well adapted for selection. The transmitter generates several systems of waves, all of which, except one, are useless. As a consequence, only an infinitesimal amount of energy reaches the receiver and dependence is placed on extreme amplification, which can be easily effected by the use of the

radio waves of mechanical perfection, but while helpful in many ways, they have drawn the experts away from the simpler and much superior arrangement which I attempted to introduce in 1901. My plans involved the use of a highly effective and efficient transmitter conveying to any receiver at whatever distance, a relatively large amount of energy. The receiver is itself a device of elementary simplicity partaking of the characteristics of the ear, except that it is immensely more sensitive. In such a system resonant amplification is the only one necessary and the selectivity is so great that any desired number of separate channels can be provided without going to waves shorter than a few meters.

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Gramophone Records Pictures.

Swiss Tells French Academy

PARIS, Sept. 10 (AP).—A Swiss scientist from Geneva, whose name is given as Dussaud, has sent the French Academy of Sciences a paper in which he says he has invented a new system of television.

His system, he said, is based on the principle of registering pictures electrically on gramophone records and reproducing them by means of an ordinary television apparatus.

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Sept 7 1932

AMERICAN—A Paper for People

ELECTRICITY'S VALUE CITED IN WAR ON CANCER

Scientist Declares Million
Volts Can Be Used Without
Discomfort to the Patient

Should cancer be treated with electric currents, with radium, or with the knife?

This question engaged attention of scientists and physicians attending the Eleventh Annual Congress of Physical Therapy at Hotel New Yorker yesterday.

Nicola Tesla, eminent in electrical research and sender of the first wireless message around the world, favors electric current treatments. He said:

"Radium emanations are always hazardous, being difficult to confine to the precise region under treatment."

EXPLAINS APPARATUS.

Tesla went on to explain how an apparatus in his laboratory, producing 80 million electrical oscillations in a second, could be used in cancer treatment.

"With it the body may be charged with a pressure of about one million volts, which may be borne without discomfort, although the same voltage would cause explosion of a piece of metal."

Doctors Harold Swanberg and Arthur E. Perley, differing with Tesla, favored radium in cancer treatment. Dr. Swanberg said:

"One nationally known clinic has found that over 60 per cent are cured if the patients present themselves while the disease is in the early stages. Even in the more advanced stages, 12 per cent are cured by radium."

ADVOCATES KNIFE.

Dr. Edward H. Trowbridge, speaking before a special conference on surgery, advocated the knife in cancer treatment, but a new sort of knife, operated by electricity. He said:

"This knife makes it possible to operate in cancer cases before considered hopeless. An electrical current emanating from the tip of the knife does the actual cutting, and in the process it also stops bleeding and seals up nerve-tips."

Other noted physicians who spoke were Dr. Frank H. Krusen, associate dean of Temple University School of Medicine, Philadelphia; Dr. Allen T. Newman, dean of New York University College of Dentistry, and Dr. Charles F. McCarthy, director of physical therapy, New York City Department of Hospitals.



Ultra-Short Radio Waves Bent By Marconi in Test for Vatican

Discovery Permitting Transmission to Overcome
Curvature of Earth Is Expected by Experts
to Revolutionize Air Communication

By The Associated Press

ROME, Aug. 13.—Giuseppe Marconi has made another advance in the science of radio communication, he disclosed today, by "bending" ultra-short radio waves, which heretofore he had been unable to transmit through obstacles.

From his yacht Elettra, in the Gulf of Aranci, Island of Sardinia, he sent word to his collaborator, Marchese Luigi Boleri, that messages had been dispatched successfully on fifty-seven-centimeter waves from Rocca di Papa, south of Rome, across the Tyrrhenian Sea to Cape Figaro, in the Gulf of Aranci, a distance of 270 kilometers (168 miles). Portable reflectors were used, communicating clearly both by radio telegraph and radio telephone.

Today's discovery permits transmission on ultra-short waves in such a manner as to overcome the earth's curvature. This, said Senator Marconi, is proof that the ultra-short wave is not definitely limited by all obstacles.

His associates attributed great importance to the discovery because heretofore it had been possible to use ultra-short wave communication only between two points in a line of vision.

The waves would not pass through houses, trees and similar objects. Senator Marconi has been trying for a year to "bend" the waves.

Experts here said that if he had overcome the obstacle of the earth's curvature he could overcome other obstacles, thus greatly extending the possibilities of ultra-short wave communication. This method, they said, eventually would revolutionize radio transmission, for it is infinitely cheaper and simpler than methods in use at present.

The inventor has been pushing his experiments recently to apply them in a first installation for Pope Pius XI between the Vatican and the papal summer home at Castel Gandolfo.

May Effect Economies, Experts Say

New York broadcasting engineers expressed great interest yesterday in Senator Marconi's achievement. One said that his development might make possible great economies in transmission and avoid interference among thousands of stations.

A. B. Chamberlain, chief engineer of the Columbia Broadcasting System, said: "Until now, utilization of the ultra-high-frequency band of radio (Continued on page fifteen) G4

Marconi Bends Ultra-Short Radio Waves

(Continued from page one)

waves has been possible only between two points in a line of vision. Marconi's discovery will probably be of great importance in the future, as it will make possible the use of ultra-short waves in a line of vision. It is expected that the discovery will be of great importance in the future, as it will make possible the use of ultra-short waves in a line of vision.

It is also possible that he has developed some new principle which will make possible the use of ultra-short waves in a line of vision. It is expected that the discovery will be of great importance in the future, as it will make possible the use of ultra-short waves in a line of vision.

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Declarations of Faith

By Joseph Auslander

NIKOLA TESLA, acknowledged dean of American inventors, in a recent interview on his seventy-sixth birthday, reaffirmed his faith in the recuperative vitality of our old universe and proclaimed his enthusiastic belief in the tremendous possibilities of the future with such vigor and such ringing confidence as to shame the cowardly croakings of our modern Cassandras.

Coming on the heels of John D. Rockefeller's robust testament to the world on the occasion of his ninety-third birthday, this exhibition of courage, industry and tenacity on the part of our elders should give us pause. We have endured a devastating plenty of professional pessimism. It is easy enough, Heaven knows, in time of general distress to cultivate a down-at-the-mouth attitude. It is, indeed, far easier than any declaration of faith.

WHEN Tesla, with a boyish exuberance that mocks his years, informs the world that he has had "a very successful year," it is in the best interest of the world to listen. "I have made two inventions," he continues, "among the most important of my life. When they are announced one will be like the hundred thousand trumpets of the Apocalypse. The other will be less sensational, but it, too, will be important. It will be like the shout with which Joshua's army brought down the walls of Jericho!"

When Rockefeller asserts his unwavering adherence to "the fundamental principles upon which this country was founded—liberty, unselfish devotion to the common good and belief in God"—he is, it would appear, championing an unpopular credo. This talk of "liberty" and "unselfish devotion to the common good" is hardly calculated to sit well on an empty stomach. We can understand that. We can readily appreciate the cynical doubt which might well greet the catchword "liberty" in a land fettered to a vicious amendment. We cannot in all conscience blame that considerable portion of our people which has been betrayed and robbed and crucified by overlords whose "devotion to the common good" would warrant a strenuous use of the whipping post.

BUT these "fundamental principles" remain fundamental and true nevertheless. If anything, they are more fundamental, more true than they have ever been. That we have traduced these principles is unquestionable. And yet, as principles without which no democratic government can endure, they are not lightly to be dismissed. They were born out of blood and anguish and enormous travail. They will continue to exact a bitter price. But they are worth it.

"Let us," says Rockefeller, "as a nation, looking proudly to our past where it has been noble, and recognizing with humility our mistakes of extravagance, selfishness and indifference, let us, with faith in God, in ourselves and in humanity, go forward, courageously resolved to play our part worthily in building a better world."

IT is our profound conviction that both Tesla and Rockefeller will contribute mightily toward the building of that better world. It is our prayerful hope that they may live to enjoy the fruits of their building.

finds him kneeling... interests has to be... vation for Europe with her bundle of... new States is to come. The ideas of... cooperation, service and leadership... of the able have to be endorsed no... decency of present efforts to per... peluate... and fire... been out a long ago. I, for one... elation which is charged with being... the sole offender. Although he goes... as a Democrat, we who live in other... States wonder if such things as this

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I have this idea years ago and it will be carried out in a much simpler way than here described.

•The ROCKET in the

The problem of making war effective has become that of destruction from the greatest distance. The rocket stands out as the most far-reaching potentiality for attack on a distant foe.

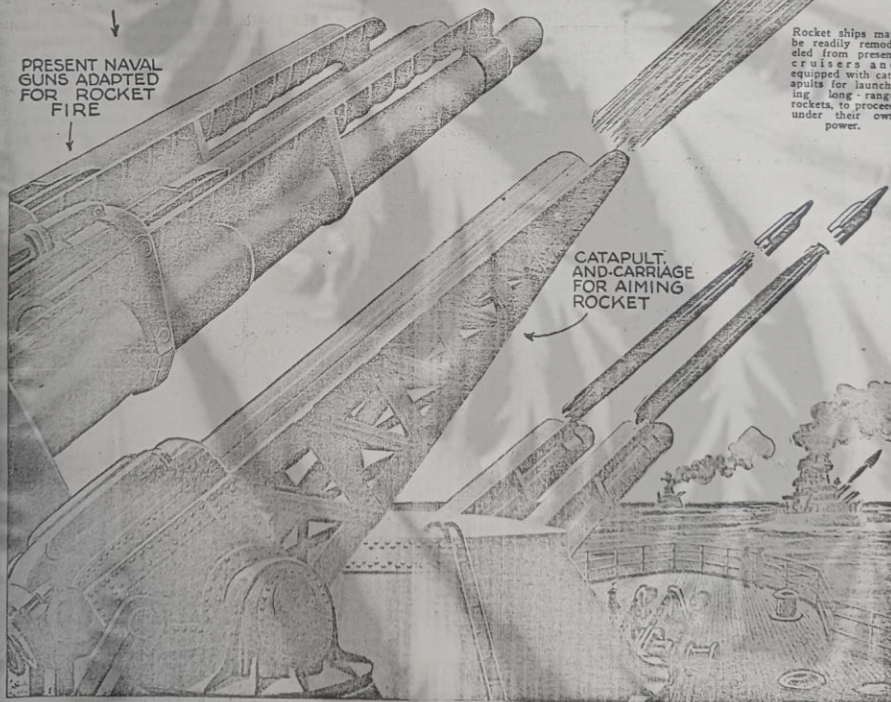
“THE whole nation will find itself on the firing line,” said Marshal Foch, looking forward to “the next war.” To understand how the rocket will dominate future conflicts, consider the question of destruction by long-range bombardment, one of the expedients of scientific militarists.

Assume that two nations are at war and their armies have been rushed to the frontier. The strategy of the new warfare will call for the prevention of an enemy invasion and, simultaneously, the destruction of the enemy's strategic centers by long-range shells.

Consider what this means. Long-range artillery, which previously has been used principally against opposing armies, at distances of five to twenty-five miles, must now be adapted to shoot shells 200 to 500 miles. It will be necessary, furthermore, to hit the distant targets aimed at; and to hit them often enough to complete the desired destruction. For this novel task, in my opinion, present artillery is entirely unfit and, were the success of future long-range bombardment to rest solely on artillery, one arm of the “destruction from a distance” program would surely fail. But luckily for the militarist, the rocket will supply him with the very instrumentality that he needs.

It is quite possible that, even were long-range guns constructed like mountains of steel, to withstand all the enormous strains of firing, and to give greatly increased velocities to the shells, they would yet fail to achieve the necessary ranges. For the enormous increase in the resistance of the air, at these great velocities, would reduce the speed of the shells so quickly as to minimize the effect of the added propulsive force. The additional energy imparted to a shell, to increase its muzzle velocity, might serve only to heat the casing by friction against the air, and add but little to its actual range.

This fundamental weakness of the present high-power artillery is in contrast with the effectiveness of the rocket-propelled shell as a means of effecting a long-distance bombardment. For the rocket can, first, propel shells to distances impossible with artillery; and, secondly could be shot in such numbers and with such rapidity as to constitute an avalanche of death from which there would be no escape.



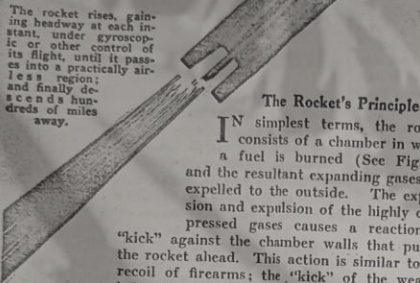
March, 1932

EVERYDAY SCIENCE AND MECHANICS

327

next WAR ?

By DAVID LASSER*



The rocket rises, gaining headway at each instant, under gyroscopic or other control of its flight, until it passes into a practically airless region, and finally descends a hundred miles away.

The Rocket's Principle

IN simplest terms, the rocket consists of a chamber in which a fuel is burned (See Fig. 1) and the resultant expanding gases are expelled to the outside. The expansion and expulsion of the highly compressed gases causes a reaction or "kick" against the chamber walls that pushes the rocket ahead. This action is similar to the recoil of firearms; the "kick" of the weapon being the reaction to the force of expulsion of the shell.

The rocket carries its own fuel; and its motion continues until the fuel has been exhausted and the momentum lost.

If, to the rocket motor, there is attached a nose filled with high explosive, gas or anything deadly that modern science can create, there is created a self-propelling shell that should make possible the fondest dreams of the militarist.

Such projectiles would be gun and shell in one and, therefore, no heavy ordnance would be necessary to shoot them. It would merely be necessary to give them a start, and they would carry themselves hundreds of miles, to strike with stunning force.

Batteries, shooting rocket shells into the heart of an enemy country, could be built by the thousands, and fired with the rapidity of small calibre artillery.

The rocket, in fact, would travel through the air, in a manner just the opposite of that of an artillery shell. Where the long-range artillery shell leaves the gun at its maximum speed, encountering at once the great resistance of the lower air levels; the rocket would leave the mounting slowly, and acquire speed only as it shot upward into the high rarefied regions of the air, where the resistance is small.

Shooting upward, thirty to fifty miles above the earth in its

passage, the rocket shell would then drop with terrifying speed upon city or munition plant.

War to the Utmost

WHAT would this mean in an actual conflict? Scanning the map of Europe, we see that Paris could easily be shelled from the German border, and Berlin from the Rhine. London would be within range of both French and German shells; and Little Switzerland, now a buffer state against the progress of opposing armies, might find itself arched by a rain of Italian and French rocket shells, hurled into enemy territory.

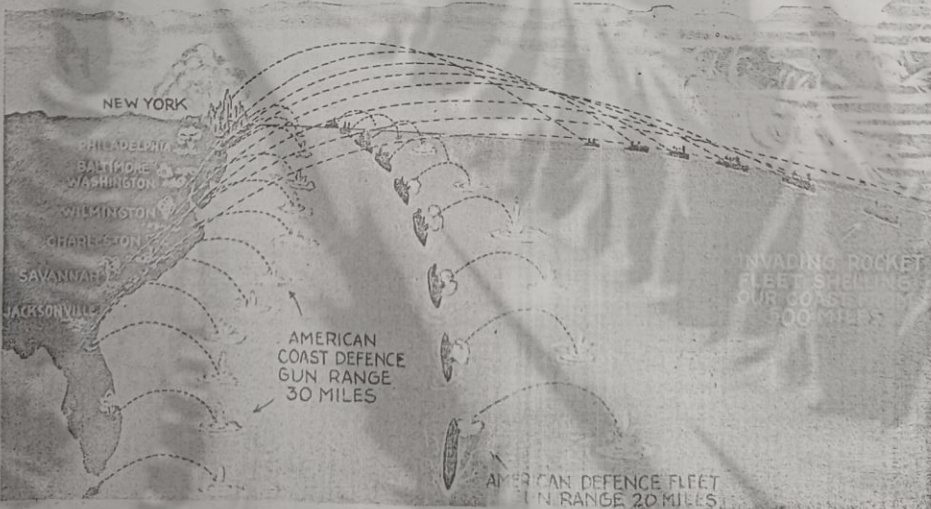
Each nation could devastate the other in a rain of death, from which there could be no relief. All of the creative and destructive facilities of man could be destroyed without a foot being set across an enemy border.

Let us imagine the effect of the rocket upon America, in its supposed isolation. An enemy fleet may start upon the invasion of America equipped with rocket batteries that shoot shells 200 miles or more. This is possible, since no heavy ordnance need be carried to shoot them. The fleet could anchor off our coast and reduce our forts to a mass of ruins. Our sixteen-inch coast-defense guns, with maximum ranges of 30 miles, would be toys, compared to the naval rocket batteries.

Boston, New York, Philadelphia, Baltimore and Washington could be reduced by an enemy fleet resting in safety in the Atlantic; or our Pacific ports might fall without a serious blow being struck.

For emphasis I record an editorial of the *New York Times*, of October 10, 1931, commenting upon the perfection of anti-aircraft guns. "What was to happen in the next war," said the *Times*, "has been described in terms calculated to frighten every nation out of its growth, if the predictions were taken without a thought of the means of protection. In such a vast convulsion the airplane would be the means of destruction. If a defense from the ground could be contrived countries would feel safer."

*President, American Interplanetary Society; author, "The Conquest of Space."



Against an invading fleet armed with long-range rockets, the heaviest of coast defense and naval guns might be as useless as clubs and spears. The extension of battle areas would be as revolutionary as in the days

of introduction of the modern rifle and the airplane. Assaults would be directed upon known objectives, by man; just as in long-range artillery fire of today which is directed upon invisible targets.

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finds him kneeling
Poniatiebleau looking

composited defective
the whole production
Each competitor who
of it, if he plays fair,
mind a possible solu-
the writer of the final
will have the hardest
to a logical conclu-
complications spun out
re.

One of Norway's most
important newspapers,
Morgenbladet, re-
cently issued the first
index to its news. It
is the first of its kind
in a continent and has,
Miss MANNSTAD, tells
read after the Anglo-
used by The Glasgow
The London Times
own New York Times
the index is in Nor-
mality of that lan-
is striking enough
test hardship to the

no doubt of the mean-
ing Bankvesen, Nobel-
Verke Arbeiderparti,
are to be found the
column of each story.
In a century scholars
the newspaper as his-
tory. But only the
wool researcher can
take the time neces-
sary to get the infor-
mation from the
he is forced to turn
page in the hope of
find his story. Those
and over the biograp-
hy, and many
with feeling of the
ending material which
can be got from
how? It may be
prompted Morgen-
sen index of its own.

Wins Applause.
New York Times:
open very often, and
they deserve credit.
Holmgren, No. 10497.
a Beach train last
at Twenty-second
woman left the car
pursue. She had run
told him, and he
back several cars.
handed it to her
and continued
toward, usually very
comes to liking the
himself completely and
himself a round of ap-
peal. **ATHAN BALTIMORE**,
Feb. 19, 1932.

STRAIN.
and break beneath
of
sun-haw
the
one. Hopefully I try
a few. Somewhere in the
of it

Nei, a little rift of blue
phon warmth and light
"The
who
of sun along my
re fin
Ponia beneath my over-

GRACE REINI.

the world to one's own self and its
interests has to be overcome if sal-
vation for Europe with her bundle of
new States is to come. The ideas of
cooperation, service and leadership
of the able have to be endorsed so
that every nation should develop its
abilities and utilize them for the sake
of the whole Commonwealth. Then,
also, a re-evaluation of the nation
will be possible. Germany cooperat-
ing with Lithuania will not try to
Germanize the Lithuanians, for she
will see the value of Lithuanian
achievements, and that they finally
are to Germany's own advantage,
and vice versa. Such a cooperation
would not be new. I only recall the
fact that the Germans have done a
great piece of work in helping to
collect and edit the wonderful Lithu-
anian folksongs. Here we have an
honest exchange of the very best
achievements of two nations. Why
not throw away the narrow, national-
istic, individualistic viewpoint?

HANS DECKE.

Princeton, N. Y., Feb. 19, 1932.

THE TESLA EXPERIMENTS.

Further Light Is Sought on Conclu-
sion Regarding the Cosmic Ray.
To the Editor of The New York Times:
In a recent letter to THE NEW
YORK TIMES Nikola Tesla recalled a
startling theory of the cosmic rays
and radioactivity which he claimed
to have discovered and announced
many years ago.

He says that in 1899 he "obtained
mathematical and experimental
proofs that the sun and other heav-
enly bodies, similarly conditioned,
emit rays of great energy which con-
sist of inconceivably small particles
animated by velocities vastly exceed-
ing the velocity of light."

He does not describe these experi-
ments and his references to their
previous publication is quite general
and not specific. Also he does not
tell us by what mathematical opera-
tions he analyzed the motion of par-
ticles moving with a velocity "vastly
exceeding the velocity of light."

These experiments and theories of
Mr. Tesla are entirely unknown to
physicists of the present time. I
have never seen any reference to
them in the literature of physics and
in the proceedings of scientific soci-
eties.

More than fifty years ago Sir J. J.

Thomson, the most distinguished

pupil of the great Maxwell, published

an essay in which he proved by the

electromagnetic theory of his great

teacher that no electrified particle

can move with a velocity equal to or

greater than that of light. The late

Professor Lorentz, by extending

Maxwell's electromagnetic theory,

obtained results that agree with

those of Sir J. J. Thomson. The

theory of Lorentz expressing the re-

lation between the mass and velocity

of moving charges forms a funda-

mental part of the special relativity

theory of Einstein.

The theory of Lorentz shows that

the mass of such particles will in-

crease as the velocity increases ac-

cording to a definite law, and at the

velocity of light the mass and en-

ergy of the particle will become in-

finite. Experiments on moving

charged particles exactly confirm the

theory of Lorentz. Experiments

have been made with particles hav-

ing velocities greater than 99 per

cent of the speed of light. The pro-
portions of our population does not
occur to the landlords' advocates.
Nor do they realize the social in-
decency of present efforts to per-
petuate a system of conditions
and fire hazards that should have
been outlawed long ago. I, for one,
hope that sufficient indignation will
be displayed here and in Albany to
make success impossible.

STANLEY M. ISAACS.
New York, Feb. 19, 1932.

Webster on Washington.
To the Editor of The New York Times:
It is just one hundred years since
Daniel Webster delivered his great
address on George Washington at
the centennial celebration in Wash-
ington. It seems to me many would
be interested in reading the last

paragraph. Years hence, other
disciples of Washington will celebrate
his birth, and no less sincere admi-
ration will be shown to him. When
we meet, to be sure, and him that
honor, so as they shall see the
blue sun, his native mountains
rise in the distance, surely as they
shall behold the banks he rests,
he lived, and the sea, so
surely in the distance we now see
the flag, and the sun, then as now,
top of the mountain, his visit no
land more, and his happy, more
lovely, than our own country!"

CHARLES G. MORRISON.
Sharon, Pa., Feb. 15, 1932.

Information Sought.
To the Editor of The New York Times:

These may seem like queer ques-
tions; nevertheless, I should like to
ask them. When jobs are about as
scarce as teeth, and millions
of men, so it is told, have none
at all, why are there so many strikes
in progress, threatening for in-
creased wages among other things?
If it is against the law to litter side-
walks, why do members of the New
York police force walk so dandily
through oceans of litter instead of
demanding that persons whose prop-
erty adjoins the desecrated sidewalk
immediately clean it up?

After all, even in New York, is not
crime an occasional happening in
every neighborhood, while dirt, in the
form of litter, is always with us;
and, like the housewife's duties,
should street and sidewalk cleaning
not be a daily and hourly task?

QUEER QUESTIONS.
New York, Feb. 16, 1932.

Debit and Values.
To the Editor of The New York Times:

Since the dollar is pegged to the United
States were noted, in 1916, 1917
and 1918, the commodity purchasing
power both of the dollar and of the dollar
has very greatly decreased. To press
for payment in full at present prices
is as though one should weigh out ten
tons of flour to a friend, and then
ask him to pay back ten for ten after
an accident had greatly lengthened
one arm of the balance.

I venture to believe that there are
not many American citizens who, in
private life, would ask a debtor to
continue payments under such condi-
tions, until they had first set back
the fulcrum of the balance in its
original position.

K. WASHINGTON GRAY.
South Paris, Jan. 24, 1932.

How its pocket is being plundered in
other ways. When a bitter partisan
investigation has as its chief inquisi-
tor the political enemy of the associa-
tion which is charged with being
the sole offender, although he poses
as a Democrat, we who live in other
States wonder if such things as this
are not more harmful to the future
of the party than the strained at-
tempt to impute party wrecking to
Governor Smith's announcement. A
political housecleaning within the do-
main of one's party is all right and
proper, but when it is employed by
the Opposition the hope to profit by
the acts of the sinner would seem to
be more human in its object than the
profession of good faith in the public
service. **HENRY BURT WARE**,
Salem, N. J., Feb. 19, 1932.

The Saint Memin Miniature.
To the Editor of The New York Times:

Noticing that you feature as the
most prominent picture of Washing-
ton in THE TIMES Magazine today
an enlargement of the miniature by
Saint Memin, let me call your atten-
tion to the use of this portrait on
the 8-cent postage stamp of the
Washington commemorative issue re-
cently put out by the Postoffice.

In this connection, it may be of
interest to the public, and particu-
larly to stamp collectors, to know
that the selection of the Saint Memin
portrait was probably due in the
main to the recommendation of
Albert Rosenthal, the well-known
artist and expert on Colonial paint-
ings, at whose instance I wrote the
Postmaster General in January, 1931,
when it was assumed only one por-
trait would be chosen for the entire
series, citing it for his consideration.
In that letter I transmitted the sug-
gestion that the Saint Memin pos-
sessed unusual suitability for the
purpose, adding: "I am prompted to
write you by the fact that Albert
Rosenthal of this city, who ranks
among foremost authorities on origi-
nal Washington portraits, pro-
nounces this miniature the best of
its kind, requiring no reduction in
size and presenting the desirable
sharp profile view."

The official acknowledgment gave
assurance that the Saint Memin
drawing would be brought before the
committee having the decision in
hand. It was eventually determined
to reproduce twelve different por-
traits of Washington on stamps of
as many denominations among which
this one was included.

VICTOR ROSEWATER.
Philadelphia, Pa., Feb. 21, 1932.

A New Chief Judge Needed.
To the Editor of The New York Times:

The appointment of Judge Cardozo
to the United States Supreme Court
leaves vacant the post of Chief Judge
of the New York State Court of Ap-
peals. For this there is no man
superior in learning and the adminis-
tration of the law to Judge Cuthbert
W. Pound, at present on the Court
of Appeals bench. His colleagues of
the court and many other influential
citizens and bar associations are sup-
porting the movement for his promo-
tion. The judge is a Republican, but
the elevation of Judge Cardozo by
President Hoover demonstrates the
fact that political considerations
should not influence judicial appoint-
ments. I hope that Governor Roge-
svelt will adopt the recommendations
made on behalf of Judge Pound and
promote him to the vacant position
for which he is pre-eminently suited.
SIDNEY B. PFELFER,
Buffalo, N. Y., Feb. 20, 1932.

Letters to the Editor

THE MEMEL SITUATION.

Nationalistic Viewpoint Held Opposed to Desired Accord.

To the Editor of The New York Times:

Vincent F. Jankauskas in a letter to *THE NEW YORK TIMES* makes some statements which I feel obliged to answer. He claims to state facts, and yet they are very disputable and partly obviously mistaken. A greater limitation of the word fact would seem advisable. I do not want to reply to the statement that Lithuania is entitled to sovereignty over Memel "ethnically, politically, economically and geographically," because that statement is a mere assertion of what should rather be proved.

According to Mr. Janikauskas only 10 per cent of the population of the Memel Territory is German. Even the judges by language, because it is only 60 per cent, cannot use Lithuanian in their official speech, although practically all know German. Yet, simply to call these people Lithuanians seems to be unjust, because they themselves are not Lithuanians, but belong to Lithuania and evidently favor it. Why does Mr. Janikauskas conceal the fact that in 1921 90 per cent of the population voted against being annexed to Lithuania, and that in October, 1925, 80 per cent of the German and Lithuanian estates was in favor of the one?

"Why has the Lithuanian Government never dared frankly to arrange a plebiscite to let the Memelites themselves decide on their future? Was it because they knew that the right to decide would be given to the people, and that if they would lose the valuable Memel itself the right would be given away? It seems a more just consideration when THE NEW YORK TIMES of Feb. 14 calls the Memel case 'one of the most flagrant violations of the principle of national sovereignty' and the people so eloquently devalued Woodrow Wilson."

that during the Lithuanian rule no expression of the German element was allowed is a mistaken idea. On the contrary, the promised autonomy of the territory was severely neglected. Especially the District Directory, which was formed by the Lithuanian Governor, has tried time and again to de-Germanize the population, which resulted in no Lithuanian success, but in endless quarrels between the population and the Parliament, who defended their right of autonomy.

not want to limit this reply to mere negative criticism. It seems to me that Mr. Jankauskas has become a victim of the same individualistic, chauvinistic spirit which in 1920, inspired the Lithuanians to invade Lithuania, the capital of Vilnius, which later was legalized by League. The spirit, which limits the world to one's own self and its interests, has to be overcome if salvation for the world with her people of States is to be found. The idea of cooperation, service, and "readiness to be able" have to be endorsed as every nation should develop its own strength, and then for the sake of the whole Community. Therefore, a re-evaluation of the spirit, if possible, Germany cooperates with Lithuania will not try to minimize the Lithuanians, for she values the value of Lithuanian elements, and that they finally belong to Germany's own service value. Such a cooperation is not be new. I only recall the fact that the Germans have done a great work in helping to liberate the Lithuanian folklands. Here we are at an exchange of the very best elements of two nations. Why

cent of that of light. The mass is found to be very large compared to the mass at small velocities. The mass increases enormously as the velocity approaches that of light. It would require an infinitely high voltage to give a particle the velocity of light.

Mr. Tesla maintains that his experiments and mathematical analysis prove the existence of particles moving with a velocity "vastly exceeding that of light." If this were true, it would invalidate not only Einstein's relativity theory, but also Maxwell's electromagnetic theory and its extension by Lorentz. In fact, it would invalidate the universally accepted results of modern physics. It is up to Mr. Tesla to convince the physicists that his experiments are valid and that his theory rests on solid ground.

BERGEN DAVIS.
Columbia University, Feb. 17, 1932

The Dwellings Law.

To the Editor of The New York Times,

Once again it is necessary for those interested in decent housing conditions in the city of New York to go to Albany to withstand the annual drive against those sections of the dwelling law which require the owners of a law tenement to block up a room and more safe for their occupants and living conditions in them somewhat more sanitary.

The dwelling law made other mild requirements for greater safety against fire hazard. The law provided that the ceilings of cellars in which so large a percentage of fires start should be fire-retarded so that many of the fires commencing there would be stifled at the source. It also required sprinkling down leading to the wells to prevent or at least delay the spread of fire from the apartment in which it started. The most of these changes in building and a group of landings is existing in these newer categories.

The dwellings law provides that lets new in the yard, used in common by all of the tenants, should be replaced by at least one toilet for every 100 sq. ft. In some cases three miles and on alternate floors. This promise, officially announced in the time, has been made for no occasion, and some landlords have their way.

After many years' hard fighting, occupancy of damp, dark and wholesome cellars was prohibited, despite a larger number of vacancies in the upper floors of old law tenants than in any year since 1914. Some landlords are endeavoring to have an enforcement of even provisions of the law delayed.

partially the responsibility of taking advantage of conditions which bring distress to such a large portion of our population does not seem to the landlords' advocates to do this realize the social inequity of present efforts to perpetuate wretched slum conditions. Five years ago that should have been a outlawed long ago. I, for one, believe that sufficient indignation will be displayed here and in Albany to make success impossible.

STANLEY M. ISAACS.
New York, Feb. 19, 1932.

Webster on Washington.

hundred years hence, other
people of Washington will celebrate

POLITICAL HOUSECLEANING

Its Efficacy Held to Depend Upon
Who Does It.

To the Editor of The New York Times:

The Times editorial "Through Farley at Tammany," although no doubt true in fact, cannot but serve to the injury of the Democratic party. It goes without saying that all political bodies in the large cities are in the business to keep alive their own peculiar institutions, and incidentally to lose no opportunity to add to their private fortunes. These methods are of many kinds, nearly all of which the fastidious-minded person in politics would hesitate to touch. It is evident that he has no place in the domain of practical politics.

But as a critic on the side lines, as an observer of political methods from the day of Robert Walpole to the present time, it can hardly be expected that the operators are content with the mere reward that is attached to honor and look disapprovingly on the sordid incidents of the inside workings of a government of the people. This condition of selfishness is incident in various ways from the blackest to the

"The world is who live in either
 wonder if such things as these
 not more harmful to the future
 the party than the strained at-
 tention to impute party wrecking to
 Mr. Smith's announcement. A
 deal housecleaning within the do-
 mestic of one's party is all right and
 proper, but when it is employed by
 opposition the hope to profit by
 the acts of the sinner would seem to
 be more human in its object than the
 possession of good faith in the public
 eye."
 HENRY BURT WARE,
 N. Y., Feb. 19, 1932.

the Saint Memin Miniature.
Editor of The New York Times:
Being that you feature as the

Elaborate Ceremonies

Nikola Tesla Tells of New Radio Theories

Does Not Believe in Hertz Waves and Heavyside Layer, Interview Discloses

The model of a "Tesla Coil" which will be featured in the historical exhibit of the radio show reawakens interest in its inventor.

It is not generally appreciated that this curious apparatus, often associated merely with pretty or spectacular demonstrations of high voltage electricity, is really a fundamental part of modern radio. For all the tuning apparatus and circuits in every transmitting and receiving set are simply variations of Tesla coils and Tesla coil circuits.

It was for this invention, and other inventions and principles concerned with tuning, heterodyning, and the generation of continuous waves, which were made at least several years before the very first experiments of Marconi, that many of our most reputable engineers have conceded to Nikola Tesla the title of "Father of Radio."

Mr. Tesla, still actively working, was interviewed last week to get his ideas regarding the prospects of the radio of 1930, and beyond. As a prophet, however, he balked. He had repeated time and again his visions for the future. As far back as 1900, he had contemplated a "world-wireless" system which included broadcasting, picture transmission, international time service, and in addition television and the distribution of electrical power. Part of this early prophecy has been realized—what remained, still stood as his prediction.

Disputes Hertz Waves

What, then, about power transmission by radio? Laurence M. Cockaday, the technical editor of this radio section, had expressed the opinion several weeks ago that, with present apparatus at least, it was hardly feasible. Mr. Tesla agreed to discuss the point at length. As a result, he made public for the first time one of his most extraordinary conclusions—that Hertz waves do not exist! If his theory is true, there may be found in it more adequate explanations of "dead spots," fading, reflection and a dozen other problems that have always puzzled the profession.

The inventor began by referring to Cockaday's article:

"I have read the article, and I quite agree with the opinion expressed—that wireless power transmission is impractical with present apparatus. This conclusion will be naturally reached by any one who recognizes the nature of the agent by which the impulses are transmitted in present wireless practice.

"When Dr. Heinrich Hertz undertook

(Continued on page twenty-one)

Nearly 300 Manufacturers to Show Latest Models of Sets and Accessories Monday at 2 P. M.

\$300,000 Broadcast Bill on Networks

Leading Artists to Appear in Costume Before Television and Microphones

By Lloyd Jacquet

That ever-increasing group of persons who have discovered radio there is only one Mecca this week. It is the Annual Radio World's Fair, which will unfold during six short days and nights the new 1930 pageant of radio genius and artistry.

It has been going on for six years, this annual parade of the industry's accomplishments for the twelvemonth. Yesterday ideas that were merely visions, imaginations, today realities. And somehow radio, the super-craftsman, the master showman, has performed and justified the expectancy of thousands of its devotees, who religiously pilgrimage toward the Elysian temple of its god.

Radio has a habit of doing things in a staggering, colossal way. Such is broadcasting, with its nation-wide, even international coverage; such is radio manufacture with its millions of receivers from the factories each year. And now the "biggest show on earth," the largest industrial show under one roof!

At 2 o'clock tomorrow afternoon the heavy doors of Madison Square Garden will swing open. This will be the "advance" opening, for the impatient fans may not wait till the "official" opening, which occurs at 7:30 that evening.

Radio show openings are famous. This one will be memorable. Congressman Wallace White from Maine, who fathered the present radio act, will be present as the guest of honor at the opening. Sir Thomas Lipton, noted English sportsman, and Count Felix von Luckner, German navy war raider, will give the ceremony an interesting international aspect.

During the broadcasting of this event, an annual radio ritual that takes place in the special studio built on the exposition floor, Miss Olive Shea, who has been chosen as the most beautiful radio artist in America, will, no doubt, be seen.

Beyond the portals of the broadcasting studio and into the paradise of displays, where several hundred manufacturers of sets and accessories of all sorts are bringing before the critical public eye the efforts of their technicians during the past year, thousands of hungry enthusiasts will run, look, appraise, comment and, foregather.

Radio is a complicated mystery. It is full of disturbing ramifications. This

(Continued on page twenty)

World Good Will

Program Interchange Best Peace Promotion by Nation Says Commerce Head

them. That at the same time they learn more about our nation, our people, our motives and ideals is greatly to be desired.

We may well expect that at some future date—one not so far in the future, at that—it will be possible to listen in on regularly scheduled features from distant parts of the earth. Latin-American growers will advertise their coffee or bananas around the world with characteristic programs from Brazil or Costa Rica. The spaghetti manufacturer will give us broadcasts from Milan and the jeweler will advertise his diamond stock by entraining us with "diamond miners" thralling us with "diamond miners" quartet from some South African field. Our warm summer evenings will be made more bracing as the refrigerator manufacturer brings to us a running description of a sub-zero blizzard scene in southern Argentina with pictures.

Radio the Peacemaker

These forecasts are not visionary. They are more than merely fore-shadowed. The fact awaits on the final developments only, and, as in the past, we may assure ourselves that those devoted to the necessary research are fully capable of performing the necessary miracles. Their success is inevitable. More than one threatened international clash of the future will be "called on account of radio."

The surest foundation for the betterment of relations among nations is the groundwork of closer acquaintanceship among their respective peoples. Radio is one of the most potent and effective contributions in that good work.

Viennese Tunes Featured

On WEAF Hour, Monday Vienna, which is often called "the world capital of music," is the source from which will be drawn the program of the General Motors Family Party Monday, and in which Lewis James, tenor, and Frank Black's Orchestra will be presented.

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Page 2

N.Y. Herald-Tribune
Sept 22, 1929

...straightline vol-
controls, and power resistances of
types.

...national tuners, including the
-20 and the new short wave thrill
...features that constructors will
...want to miss. Also featured will
...remote control turning device and
...complete components for making any
...of receivers.

...complete new line of resistance
...power devices will also be shown
...Acronox and the International Re-
...sistance Company, with many unique
...applications for voltage ballast and set
...control.

...there will be displayed the new
...appliance reproducer units for public
...address systems, as well as the new self-
...adjusting line voltage control of
...appliance.

...The new Insuline electrostatic light-
...ing resistor may be of interest to a
...number of suburban listeners visiting
...the show.

...Also there is bound to be a lot of
...interest shown in the complete system
...of line interference and man-made
...static eliminators displayed at the
...Stuchmann headquarters.

...Screen-Grid Popular
...All of the new receivers for home
...building and the kits and circuits seem
...to center on the use of the new screen-
...grid valves in the radio amplifiers, to-
...gether with linear power detection or
...power-charge detection, coupled with
...either one or two stages of push-pull
...amplification at audio-frequency, with
...4-5 type valves in the output
...stage. Set builders are advised to shield
...their sets up to the teeth, with single-
...control features and trimmers much in
...evidence. It is interesting to note that
...this is something agreed upon by both
...the kit designers and the engineers who
...produce the designs for the ready-made
...receivers.

...The S-M kits and parts are of even
...better construction and feature more
...radical improvements than past de-
...signs and should make mighty efficient
...receivers when put together efficiently.

...Complete Basis for Amateurs
...Although the mode for making one's
...own set is not so fashionable nowadays
...there is every chance for the experi-
...menter to go one step farther this year
...up building even a better set than in
...the days when these receivers were the
...only kind obtainable, and when any-
...body who wanted a receiver either had
...to build it himself or have some one
...handy with tools and having a knowl-
...edge of construction, build it for him.

...There is plenty of new material to work
...with and the specialists in producing
...these ingenious parts and devices have
...been generous on expense to make
...the set as complete as possible.

...At any rate the experimenter will find
...in the show a veritable haven for the
...DX fan, and the tinkerer both in new
...apparatus and with accessories for mak-
...ing the old set work better.

...Transmitting Apparatus
...For the experienced amateur will be
...shown all types of transmitting ap-
...paratus, together with new tubes and
...meters for transmitting set adjustment
...that should enable him to build more
...efficient transmitters to help him in
...his ever expanding quest for reaching
...the corners of the earth with his eter-
...nal "CQ's" and straining ears.

...The Electrostatic is the new principle,
...totally shielded lightning arrester with
...special resistance and condenser and choke
...coil filter system, together with self-pro-
...tecting fuse. The set resists the action of radio-
...activity. Absolute protection for both home and car.
...Definite static reduction and overall improvement in
...radio reception. Fully guaranteed and backed by a \$100
...insurance bond.

...Get the new Electrostatic at your dealer's or send direct
...to INSULINE CORP. OF AMERICA
...78-83 Convent Street, New York, N. Y.

...I.C.A. ELECTROSTATIC
...Double duty lightning arrester
...on all stores
...Shielded,
...—new principle
...reduces static

...The Electrostatic is the new principle,
...totally shielded lightning arrester with
...special resistance and condenser and choke
...coil filter system, together with self-pro-
...tecting fuse. The set resists the action of radio-
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...coil filter system, together with self-pro-
...tecting fuse. The set resists the action of radio-
...activity. Absolute protection for both home and car.
...Definite static reduction and overall improvement in
...radio reception. Fully guaranteed and backed by a \$100
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...Double duty lightning arrester
...on all stores
...Shielded,
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Right: Electrical fixed resistor
for use in plate circuits, and
(above) volume control unit
made by same manufacturer

Nikola Tesla Tells of New Radio Theories

(Continued from page one)

his experiments from 1887 to 1889 his
object was to demonstrate a theory
postulating a medium filling all space,
called the ether, which was structure-
less, of inconceivable tenuity and yet
solid and possessed of a rigidity incom-
parably greater than that of the hardest
steel. He obtained certain results and
the whole world acclaimed them as an
experimental verification of that cher-
ished theory. But in reality what he
observed tended to prove just its fallacy.

"I had maintained for many years
before that such a medium as supposed
could not exist, and that we must
rather accept the view that all space is
filled with a gaseous substance. On
repeating the Hertz experiments with
much improved and very powerful ap-
paratus, I satisfied myself that what
he had observed was nothing else but
effects of longitudinal waves in a
gaseous medium, that is to say, waves
propagated by alternate compression
and expansion. He had observed waves
in the ether much of the nature of
sound waves in air.

"Up to 1890, however, I did not suc-
ceed in obtaining a positive experi-
mental proof of the existence of such a
medium. But in that year I brought
out a new form of vacuum tube cap-
able of being charged to any desired
potential, and operated it with effec-
tive pressures of about 4,000,000 volts.
I produced cathodic and other rays of
transcending intensity. The effects,
according to my view, were due to
minute particles of matter carrying
enormous electrical charges, which, for
want of a better name, I designated
as matter not further decomposable.
Subsequently these particles were
called electrons.

"One of the first striking observations
made with my tubes was that a purplish
glow for several feet around the end
of the tube was formed, and I readily
ascertained that it was due to the
escape of the charges of the particles
as soon as they passed out into the
air; for it was only in a nearly perfect
vacuum that these charges could be
confined to them. The coronal dis-
charge proved that there must be a
medium besides air in the space, com-
posed of particles immeasurably smaller

than those of air, as otherwise such a
discharge would not be possible. On
further investigation I found that this
gas was so light that a volume equal
to that of the earth would weigh only
about one-twentieth of a pound.

"The velocity of any sound wave de-
pends on a certain ratio between elas-
ticity and density, and for this ether
or universal gas the ratio is 800,000-
1,000,000 times greater than for air. This
means that the velocity of the sound
waves propagated through the ether is
about 900,000 times greater than that
of the sound waves in air, which travel
at approximately 1,085 feet a second.
Consequently the speed in ether is 800-
1,000,000 feet, or 180,000 miles, and this
is the speed of light.

"As the waves of this kind are all
the more penetrative the shorter they
are, I have for years urged the wire-
less experts to use such waves in order
to get good results, but it took a long
time before they settled upon this prac-
tice.

"Although the world is still skeptical
as to the feasibility of my undertaking,
I note that some advanced experts, at
least, share my views, and I hope that
before long wireless power transmission
will be as common as transmission by
wires."

"According to Mr. Tesla, the present
broadcasting station does not propa-
gate Hertzian waves, as has always
been supposed, but acts more like an
"ether whistle"—transmitting waves
through the ether similar to the waves
transmitted by an ordinary whistle
through air. He also expressed his dis-
belief in the Heavenside layer, and

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claimed that the reflection of waves
back toward the earth was due to the
change of medium encountered at the
vacuous boundary of the atmosphere.

At Colorado Springs, about thirty
years ago, this scientist had a Tesla
coil seventy-five feet in diameter,
which produced voltages above 12,000,000,
and sparks over 100 feet long. Elec-

HIGH —and Ame

THE America
recognizing
value. A simple
Steinitz offers a
feature of high
lower-priced set

Here is a great
making the Ste-
season. "Why
radio buyers, at

What has made
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overwhelming
made possible
of a million sq
are devoted to
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unit—true or
research depart-
of the field has
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ago it produces
America's first

We have listed
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any set you have
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SUPER

Editorial Comment

Radio Waves and the Transmission of Electrical Energy for Power

DR. E. F. W. ALEXANDERSON, consulting engineer of the General Electric Company and the Radio Corporation of America, in an address at the annual dinner of the Sigma Xi Society at the Hotel Astor in New York City, last April, predicted that the radio wave would soon be used for the control of vast amounts of power, and would supersede much of the cumbersome machinery now used in power production and transmission.

"The electric power industry cannot remain much longer untouched by the discoveries of radio," he said. "It is just waiting until this new knowledge has been widened and matured, so that it can be put into use on a wider scale, and this is the real significance of the entrance of the electrical industry into radio, and the latest branch of it, television."

Ten days after Dr. Alexander's startling prediction, electric lamps, held or suspended in the air without any connection to power wires, were made to glow brightly when high frequency waves were directed upon them in a demonstration of power transmission by radio by two Westinghouse engineers, Dr. Phillips Thomas and Dr. Harvey C. Rentschler, before the New York Electrical Society in New York City. Dr. Rentschler also displayed a novel radio furnace, in which metallic tungsten, among the most infusible of all metals, was heated white hot in an instant by the radio waves.

"We may visualize," said Dr. Thomas at this demonstration, "a parallel beam of radiation ten centimeters (four inches) across, along which is being sent ten kilowatts of energy. What sort of effects shall we find? Will this be the means for delivering energy for heat and light to individual houses? Dr. Nikola Tesla had a similar idea several years ago. Later improvements in the radio art make it interesting to consider such a possibility once more."

Guglielmo Marconi, inventor of the Marconi wireless system, while visiting this country last October, for the first time in several years, delivered an address on radio before a notable gathering of scientists at the Engineering Societies Building in New York City, in which he said:

"I hope I will not be thought too visionary if I say that it may be possible that some day electric waves may also be used for the transmission of power, should we succeed in perfecting devices for projecting the radiation in parallel beams in such a

manner as to minimize their dispersion and diffusion into space."

Dr. Nikola Tesla, one of the earliest pioneers in wireless, inventor of the alternating current system of power transmission, the induction motor, and many other notable electrical devices, the day before Marconi made the foregoing appeal "not to be thought too visionary," wrote a modest but direct statement of what he has already accomplished. Dr. Tesla said:

"The transmission of power without wires is not a theory or a mere possibility, as it appears to most people, but a fact demonstrated by me in experiments which have extended for years. The recent demonstrations of a number of experts with very short waves, have created the impression that power will be eventually transmitted by such means. In reality, experiments of this kind are the very denial of the possibility of economic transmission of energy. No concentration of energy such as I attain in my wireless power system can or will ever be achieved through the instrumentality of reflectors, for in transmitting energy in this manner the receiver can collect only an amount proportionate to the area exposed to the rays, while in my system it draws the energy from an immense reservoir in ever so much greater quantity. My plans for a power plant have been developed to the point of application, and I am using every effort to give to the world this, my best and most important work, as soon as possible. I have in view a number of places which seem well suited for the purpose, but my warmest wish is to transmit power from Niagara Falls, where the first triumph with my alternating system was achieved."

And meantime the entire world, with its vast resources of electrical energy in inland lakes, rivers and waterfalls, coal, wind, ocean waves and heat of the sun going to waste in billions of horsepower every day, waits patiently while radio scientists monkey with bulbs and reflectors to carry giant loads of chained lightning. It is about time some of them wake up to the fact that while they are shuffling around with little short-wave reflector sparks, Dr. Tesla has experimented with tremendous electrical power flashes, each more than one hundred and fifty feet in continuous length, under perfect wireless control. Dr. Tesla has said so himself, his veracity is unquestioned, and his record of great accomplishments thus far backs him up. The "big business" end of the electrical industry ought to dig Dr. Tesla out of his laboratories long enough to say to him "Show me!" for there is enough money in it to suit even the wildest dreamers of Wall Street if he is right.

A Logical Discussion on the Transmission of Power by Radio

Experimenters Have Been Devoting a Great Deal of Their Time Trying to Solve This Problem

By KENNETH M. SWEZEY

RADIO has sprung unusually fast from technical obscurity to a popular utility, through broadcasting, and to many it seems to have reached its limit of perfection and usefulness. Transmitting stations have arisen in numbers sufficient to intermesh their waves in a blanket which covers every acre of the country. Receiving sets are so thick that their antennae spider-web the horizon line. The broadcast programs are in portions of the cycle above the reproach of the most fastidious. What more could one want? What more is possible?

In answer to those questions the echoes of a dozen unsolved problems assert themselves. How can static be eliminated? Who will pay for future broadcasting? When can the owner of a set be freed from technical worry? How can receiving set upkeep be minimized? How can distortion be done away with? What are the limiting factors of super-power?

Important Question

The question of who will pay for broadcasting is an old one, and misleading. The people who use the sets, of course, always pay; no matter what distribution or collection system is used. It resolves itself to a question, rather, of how, by what specific means, will the expenses of broadcasting be paid. At present the sale of sets and parts, and of general merchandise through ethical advertising,

as it stands, the system is backwards. For all the power that is used in the six hundred or so transmitting stations of the country, at least twenty times as much is used in the aggregate of receiving sets. Perhaps this before has been overlooked but it stands out defiantly. Assuming that the six hundred stations broadcast with an average of 1,000 watts, and that two million tube receiving sets consume an average of 6 watts each—which is low, by the way—then a total of 600,000 watts would be propagated and a total of 12,000,000 watts be used to make it audible at the receivers.

A Possible Solution

That fundamental weakness is responsible for the necessity of five and eight tube sets—those expensive white elephants which advanced fans must now have in order to meet certain particular requirements. If appreciable power could be conveyed to the receiving set a single tube, or even a crystal, could do the work of an eight-tube super-heterodyne; at the same time requiring greater ease of control and less distortion. The works of a set then would need not cost more than \$10 or \$15, and what upkeep expense there was would be chiefly for the actual broadcasting service.

The cost of bare maintenance of a three-tube set—tubes and battery, could amount to about \$30 a year. Most likely this is too high and you should be

If but less than a single watt were available at the receiver no tubes would be needed, even for operating a loud-speaker. If energy could be transmitted efficiently a total of 2,000 kilowatts would suffice for all our present needs and could be sent from four super stations of 500 kilowatts each.

Then with the best of paid talent the annual cost of both the transmitting and receiving set upkeep could well stay below \$15,000,000.

But with our present system this is obviously impossible. The waves sent out are chiefly radiations, and because they are such the greatest part of their energy is irretrievably lost.

Beam Transmitter

By concentrating the waves into a beam the recoverable energy is increased, but in the same degree the usefulness as a broadcast transmitter is decreased, for the area over which the waves may be intercepted is restricted.

It is this lack of power weakness that is also the main cause of static trouble. Atmospheric electricity will always be with us, and its nature is so closely allied to that of radio waves that it cannot be eliminated in any practical way so long as its intensity approaches and exceeds that of the impulses that are wanted. The only satisfactory solution to the problem seems to be in increasing the available

power. The ones that are greatest always win.

Distortion, too, is due chiefly to a lack of antenna energy in the receiving set, for it comes through the inaccurate repeating of regeneration, through small differences in tube characteristics and through interstage transformers. If there was the energy available at the antenna that is now available at the output of the last tube the amplifier could be eliminated, and with it the distortion that it produces.

One often reads in the press the announcement that some one at last has found means to send power by radio. If it were true the industry of the world would be revolutionized. As facts stand, this has not as yet been practically accomplished. Lamps can be lit by the radiations of the ordinary transmitter over very short distances, but the efficiency is so extremely small that commercial promotion of the phenomenon would be ridiculous.

Nikola Tesla was the first to try to solve the problem, and if success is ever achieved it will doubtless be by his system, into which he has put so much of his life. Professor Heilmholtz, Lord Kelvin and a number of able contemporaries believe the plan entirely feasible. It apparatus could be developed to generate and control the proper kind and intensity of electricity. Tesla has long since done this, and the system seems only

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THE NEW YORK HERALD TRIBUNE RADIO MAGAZINE

BY JAMES S. CAUL

INVENTOR

Radio

65

NEXT WE

The Evening World RADIO

ISSUED AS A SECTION OF THE EVENING WORLD.
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NEW YORK, SATURDAY, MARCH 15, 1924.

Radioed Light, Heat and Power Perfected by Tesla

INVENTOR ANNOUNCES FINAL SUCCESS OF EXPERIMENTS BEGUN THIRTY YEARS AGO

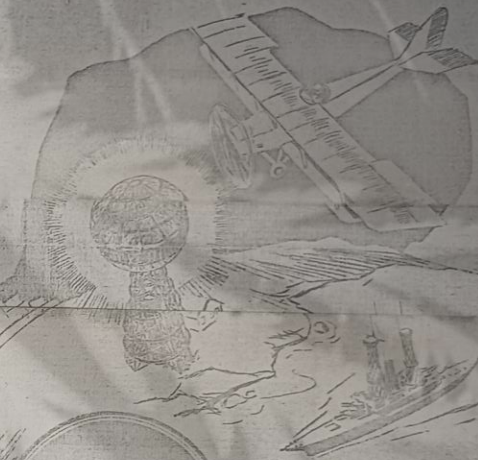
By James S. Caulfield
Assoc. A. I. E. E.

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LIGHT, heat and power without the aid of wires is nearing the stage of completion. Prof. Nikola Tesla broke through of many years to announce the perfection of his system for transmitting power without wires. By means of this power it will be possible to light homes, offices and streets; furnish power to run ships, airplanes and all types of electrical machinery. He is now making preparations for the erection of the transmitting power plant.

Prof. Tesla was born in Smiljan, in the kingdom of Croatia, at the University of Zagreb, and received honorary degrees from Yale and Columbia Universities and from the Polytechnic in Vienna. He came to this country in 1884 and took out his first patent for his wireless communication system in 1897.

He was the only woman inventor of his part of the country, where she has studied with her father, also an inventor. Tesla's father, his mother, and his sister, all died in 1911, when he made his first wireless transmitter.



Special Features

- A New Reflex Circuit... Page 3
- A Night With Will Johnstone and the Radio Artists... Page 5
- An Efficient Australian Circuit... Page 16

After an interview with Prof. Tesla in his apartment on Park Avenue the writer can confidently state that the famous inventor is one of those few productions of nature that have been formed perfect. His individuality is absolute and his mind is the embodiment of concentrated and continuous thinking. Thinking is his life work and his pleasure. He is always thinking, and in his flights of imagination there is nothing which is impossible, nothing which is not at some time realized.

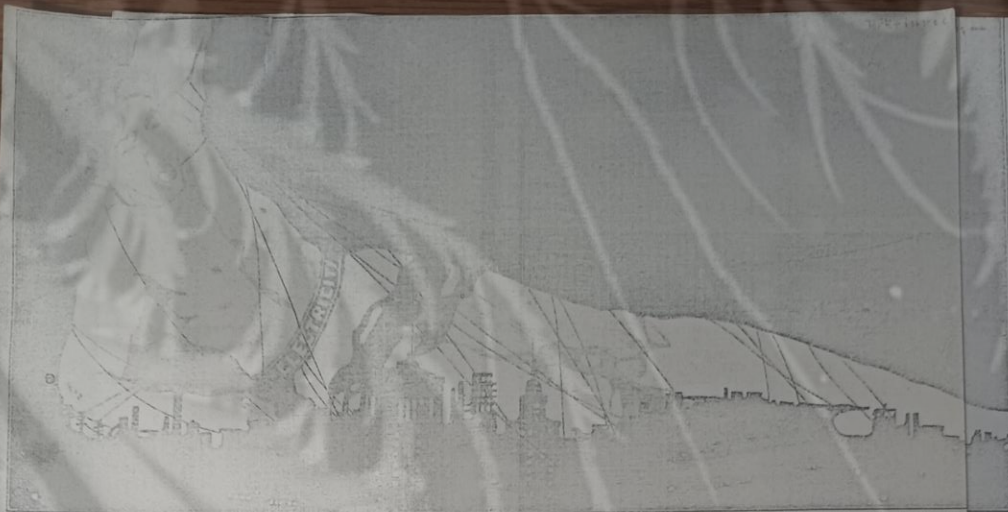
His passion for the new is intense. Naturally of an extremely emotional disposition, his nerves are constantly at a fearful tension. His will power is also enormous. Mr. Tesla's power of concentration makes him deeply solitary, and his labors and workings are carried out in the quiet solitude. His experiments are carried on in his own apartment, and to the utmost they would never be carried out in the presence of originality.

At one time many of his friends deplored him as

a dreamer and others called his schemes ridiculous. On close inspection his ideas will be found to be twenty-five to one hundred years ahead of time. Here is an example: Back in 1888 The Evening World printed an exclusive interview with Tesla, at which time he stated that the power of Niagara Falls would be developed. The public thought light of it and in a short time it was forgotten. However, some eight years later the Falls were developed and at the present time plans are being made to transmit power from Niagara to supply the New England States.

In the same year Tesla, through the medium of this paper, announced that he had developed a system of communication for ships at sea. This was three years earlier than the famous Marconi's experiments. Other inventions of this master electrician made it possible to transmit an alternating current of electricity. The development of systems for trading cars and airplanes and electric drive in cranes all owe their being to (Continued on Second Page)

WEEK-END BROADCAST PROGRAMS--PAGES 7 AND 10



Electricity is a youthful giant. Not yet do we know its power.

WHAT WE WILL DO WITH ELECTRICITY

BY
NIKOLA TESLA

WITH DECORATIONS BY

R. F. HEINRICH

MANY a would-be discoverer, failing in his efforts, has felt the regret to have been born at a time when everything has been already accomplished and nothing is left to be done. This erroneous impression that, as we are advancing, the possibilities of invention are being exhausted, is not uncommon. In reality it is just the opposite. Spencer has conveyed the right idea when he likened civilization to the sphere of light which a lamp throws out in darkness. The brighter the lamp and the larger the sphere the greater is its dark boundary. It is paradoxical yet true to say, that the more we know the more ignorant we become in the absolute sense, for it is only through enlightenment that we become conscious of our limitations. Precisely one of the most gratifying results of intellectual evolution is the continuous opening up of new and greater prospects. We are progressing at an amazing pace but the truth is that even in the fields most successfully exploited the ground has only been broken. What has been so far done by electricity is nothing compared with what the future has in store. By this, but there are now innumerable things in old-fashioned ways which are inferior in economy, convenience and many respects to the new method. So great are the advantages of the latter that whenever an opportunity presents itself the engineer advises his client to "do it electrically."

Consider, in illustration, one of the largest industries, that of coal. From this valuable mineral we chiefly draw the sun's stored energy which is required to meet our industrial and commercial needs. According to statistical records the output in the United States during the past year was 120,000,000 tons. In perfect engines this fuel would have been sufficient to develop 200,000,000 horsepower steadily for one year, but the squandering is so reckless that we do not get more than five per cent. of its heating value, on the average. There is an appalling waste in mining, handling, transportation, storage and use of coal which could be very much reduced through the adoption of a comprehensive electrical plan in all these operations. The market value of the yearly product could be easily doubled and an immense sum added to the revenues of the country. What is more, inferior grades, billions of tons of which are being thrown away, might be turned to profitable use.

Similar considerations apply to natural gas

and mineral oil, the annual loss of which amounts to hundreds of millions of dollars. In the very near future such waste will be looked upon as criminal and the introduction of the new methods will be forced upon the owners of such properties. Here, then, is an immense field for the use of electricity in many ways, vast industries which are bound to be revolutionized through its extensive application.

To give another example, I may refer to the manufacture of iron and steel which is carried on, in this country, on a scale truly colossal. During the last year, notwithstanding unfavorable business conditions, 31,000,000 tons of steel have been produced. It would lead too far to dwell on the possibilities of electrical improvements in the manufacturing processes themselves and I will only indicate what is likely to be accomplished in using the waste gases from the coke ovens and blast furnaces to generate electricity for industrial purposes.

Since in the production of pigiron, for every ton about one ton of coke is employed, the yearly consumption of coke may be put at 31,000,000 tons. The combustion in the blast furnaces yields, per minute, 7,000,000 cubic feet of gas of a heating value of 110 B. T. units per cubic foot. Of this total, without making special provision, 4,000,000 cubic feet may be made available for power purposes. If all the heat energy of this gas could be transformed into mechanical effort it would develop 10,350,000 horsepower. This result is impossible but it is perfectly practicable to obtain 2,500,000 horsepower electrical energy at the terminals of the dynamos.

Utilization of Waste Gases.

IN the manufacture of coke approximately 9,400 cubic feet of gas are evolved per ton of coal. This gas is excellent for power purposes, having an average heating value of 600 B. T. units, but very little is now used in engines, largely because of their great cost and other imperfections. A ton of coke requires about 132 tons of American coal, hence the total coal consumption per annum on the above basis is nearly 41,000,000 tons which give, per minute, 735,000 cubic feet of gas. Assuming the yield of surplus or rich gas to be 335,000 cubic feet, the balance of 400,000 cubic feet could be used in gas engines. The heat contents would be, theoretically, sufficient to develop 6,660,000 horsepower of which 1,500,000 horsepower could be obtained in the form of electric energy.

I have devoted much thought to this industrial proposition and find that with new,

efficient, extremely cheap and simple thermodynamic transformers not less than 4,000,000 horsepower could be developed in electric generators by utilizing the heat of these gases, which, if not entirely wasted, are only in part and inefficiently employed.

With systematic improvements and refinements much better results could be secured and an annual revenue of \$50,000,000, or more, derived. The electrical energy could be advantageously used in the fixation of atmospheric nitrogen and production of fertilizers for which there is an unlimited demand and the manufacture of which is restricted here on account of the high cost of power. I expect confidently the practical realization of this project in the very near future and look to exceptionally rapid electrical development in this direction.

WATER-POWER offers great opportunities for novel electrical applications, particularly in the department of electro-chemistry. The harnessing of waterfalls is the most economical method known for drawing energy from the sun. This is due to the fact that both water and electricity are incompressible. The net efficiency of the hydro-electric process can be as high as eighty-five per cent. The initial outlay is generally great but the cost of maintenance is small and the conveniences offered ideal. My alternating system is invariably employed and so far about 7,000,000 horsepower have been developed. As generally used we do not get more than six hundredths of a horsepower per ton of coal per year, this water energy is therefore equivalent to that obtainable from an annual supply of 120,000,000 tons of coal, which is about twenty-five per cent. of the total output in the United States. The estimate is conservative and in view of the immense waste of coal, fifty per cent. may be a closer guess.

We get better appreciation of the tremendous value of this power in our economic development when we remember that unlike fuel, which demands a terrible sacrifice of human energy and is consumed, it is supplied without effort and destruction of material and equals the mechanical performance of 150,000,000 men—one and one-half times the entire population of this country. These figures are imposing, nevertheless, we have only begun the exploitation of this vast national resource.

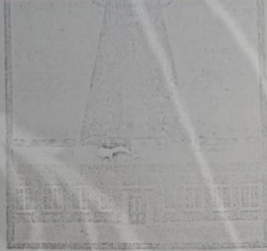
There are two chief limitations at present: one in the availability of the energy, the other in its transmission to distance. The theoretical power of the falling water is enormous. If

Transmission of energy without wires has been the life aim of the inventor. This aim he now claims to have achieved at the age of sixty-seven. For years he has virtually secluded himself in New York, living a life of solitude so as to be able to devote all his time and energy to the perfection of his wireless system of power transmission. In discussing the system which he conceived in quietude, street, shops and all kinds of enterprises, he said: "Not only is this possible, but I am confidently expecting that by far the largest amount of energy will be transmitted in this manner. The system has been fully developed and demonstrated experimentally, but most of the experts are still prejudiced. They claim that the power would be transmitted in all directions and consequently most of it would be lost, the same as in the operation of radio receivers. That is a fundamental mistake."

"It is true that my transmitter produces an effect all over the globe, but it is only force that is conveyed to every point and not energy. To make this understandable to the layman, suppose that the earth were a hollow reservoir into which water is forced by a pump. It does not require much scientific knowledge to perceive that the pressure will exist everywhere, yet no energy will be consumed. But the moment this reservoir is tapped and the water permitted to drive an engine, energy is derived from the pump. In my system energy is released by something like a combination lock, and only those who have the combination can draw from the source."

"In my original experimental demonstrations I have made great improvements and I can now definitely announce that the loss in the transmission to the greatest terrestrial distance—say 12,000 miles—will not amount to more than one-quarter of 1 per cent. This, of course, does not take into account certain unavoidable losses in the transmitter and receiver, which will amount to about 5 per cent. in the aggregate. In the present method of conveying energy through wires the loss amounts often to 20 per cent. or more and the distances are limited."

The writer asked Prof. Tesla if it was possible to



Tesla's Tower at Shoreham, L. I.

construct such a plant and actually operate it. He replied: "Most certainly, for I have developed all the details." He also stated that he expected to commence construction very shortly and rely on his own resources. He was asked if the energy transmission was accomplished by the use of radio waves, which are sometimes called Hertzian waves. He answered:

"It is quite impossible to transmit any appreciable amount of energy by such means if it were not but for one reason—that waves such as Hertzian do not have discovered to not exist. It is true that some kind of energy is radiated from the wires, but it is not in the form of transverse waves in the ether. Moreover, this energy is irretrievably lost."

"I will illustrate by an example. Suppose that two wires are fed from a generator of alternating currents and used to light an incandescent lamp at some distance. If the alternations of the current are very slow there will be virtually no energy radiated from the conductors. Imagine now that the current is made to pulsate faster and faster. Then in the same measure

will be the loss which instead of being 10 per cent. becomes 50 per cent. or more. Further, when in the direction of the wire, and then my real work is the transmission of energy without wires began. At that time it was believed that there was above the ionization air stratum surrounding the earth a shell of ionized air which was the cause of the static and it was the cause of storms in general, through which communication could be transmitted and the power transmitted by means of the ionosphere for such purposes as the radio."

"It made the marvelous discovery that the waves responded to the currents imposed upon it exactly, as though it were completely insulated in space with no conducting envelope whatever. In other words, whatever be the electrical properties of the earth, whatever be the nature of the atmosphere, or the air at high altitudes, there was no heavy conductor, a name given to the outer gaseous envelope of the earth, supposed to be rendered conductive through ionization caused by the sun's rays. This discovery showed that the most complex and rapid electrical oscillations—human speech and even power—could be transmitted through the earth far better than through any artificial cable or conductor. Experiments proved this to be the case." Tesla was asked if the wireless system would eventually supplant cable. "I would say, yes, eventually, but so long," he added emphatically, "as the art develops along the present lines, my friend Mackay needn't worry about his cables."

The illustrations show the ultimate Tesla Wireless Power Plant. In his early endeavors the inventor erected the tower shown in the photograph primarily to prove his theory. However, the war was upon us and the Government suggested that it come down. After the war Prof. Tesla again started to prove his theory, but this time he chose Colorado Springs as the location of his laboratory. It was while at the "Springs" that he first demonstrated power transmitted without the aid of wires.

U. S. Radio Anglicizing Language of the World

BROADCASTING was born in America and it is natural that this country should lead the world in use of and its associated industries. Many of the 241 broadcasting stations, however, are not equipped with transmitting radio programs throughout the North American Continent. Most of the city high-powered Class B stations, all of which are rated at 500 or more watts, and nine out of 1,000 radio power, are unable to transmit the whole world. This is because broadcasting is restricted by the use of the English language exclusively.

Some think it probable that within a few years English may come to be the "universal language" through the use of the radio. Commercial and scientific radio broadcasts, however, to Spain, also

abroad, international radio broadcasting is common in Europe today. In Great Britain, where more American stations are heard than those of any other foreign country, French has an advantage over that number of the stations of the Atlantic. Radio waves travel far better in the night than in the daytime, and this is because the ionosphere bears special marks, and the waves are transmitted after dark, now, to about 100 miles in diameter. The British Broadcasting Corporation, in fact, is the only one in the world which has a regular program of broadcasts in French. It is the only one in the world which has a regular program of broadcasts in French. It is the only one in the world which has a regular program of broadcasts in French.

Transatlantic reception of United States broadcasts began last year, and now almost every night one or two American stations are heard in England and France. German stations have also been reported in Berlin. Broadcasting from the States is heard regularly in Alaska, and every once in a while the acknowledgment of a program comes from Japan. In South America, a broadcast from Chicago, intended for the Arabs, was reported as received in Buenos Aires. Another was heard in Mexico, and stations

abroad, international radio broadcasting is common in Europe today.

In Great Britain, where more American stations are heard than those of any other foreign country, French has an advantage over that number of the stations of the Atlantic. Radio waves travel far better in the night than in the daytime, and this is because the ionosphere bears special marks, and the waves are transmitted after dark, now, to about 100 miles in diameter. The British Broadcasting Corporation, in fact, is the only one in the world which has a regular program of broadcasts in French. It is the only one in the world which has a regular program of broadcasts in French. It is the only one in the world which has a regular program of broadcasts in French.

of the country. Receiving sets are so thick that their antennae overlap the horizon line. The broadcast program is in part of the type above the horizon, but the most serious. What more could we want? What more is possible?

In answer to these questions the school of "impossible problems" must be asked: How can static be eliminated? What will pay for better broadcasting? How can the cost of a set be less than \$10 and more? How can receiving sets be eliminated? How can distortion be done away with? What are the limiting factors of superpower?

Important Question

The question of who will pay for broadcasting is an old one, and unending. The people who use the sets, of course, always pay; no matter what distribution or collection system is used. It reduces itself to a question, rather, of how, by what specific means, will the expense of broadcasting be paid. At present the sale of sets and parts, and of general merchandise through editorial advertising, pays, but whether this is an ultimate solution is dubious.

As long as the number of broadcasting stations tends to three figures, and the number of radio manufacturers tends to four, there can hardly be a totally satisfactory distribution of toll. Tasting tubes of batteries would not be fair, for who can say that the owner of a single tube set does not have all the services and advantages—in his way—that a broadcasting station could give in the owner of an 8-tube set? Government licensing would be no better, for there would be no way of honestly apportioning the collected money.

If there were but two or three manufacturers—and that is perfectly feasible, if apparatus could be sufficiently developed so that it could be standardized—and four or five broadcasting stations for the entire country, the question of payment for broadcasting could be more satisfactorily met. Apparatus could be rented like Bell telephones, or sold outright. The standard typewriters, and the user could at all times be sure of reliable maintenance service. The several broadcasters could afford to furnish the best of programs, for they would have a definite, permanent source of revenue.

the six big-band stations broadcast with an average of 1,000 watts, and that two million tube receiving sets consume an average of 5 watts each—which is low, by the way—then a total of 200,000 watts would be propagated and a total of 12,000,000 watts be used to make it audible at the receivers.

A Possible Solution

That fundamental weakness is responsible for the economy of size and efficiency which characterizes the tube-type set—those super-tubes which have in order to meet certain engineering requirements. If appreciable power could be conveyed to the receiving set by a single tube, or even a crystal, could do the work of an eight-tube superheterodyne at the same time generating greater ease of control and less distortion. The work of a set then would need not cost more than \$10 or \$15, and what super-power expense there was would be chiefly for the actual broadcasting service.

The cost of bare maintenance of a three-tube set—tubes and battery—may amount to about \$20 a year. Multiply this by two million and we have the figure of \$400,000,000—just for keeping the tubes of the receiving sets lit. It has been said that a broadcasting station cannot keep going on less than \$10,000 a year. Some run as high as \$200,000. For the entire country the broadcasting expense must run above \$10,000,000 a year.

in and from 1- or super stations of 500 to 1,000 watts each.

Then with the best of paid talent the amount of both the transmitting and receiving set expense could well stay below \$15,000,000.

But with our present system this is absolutely impossible. The waves sent out are chiefly radiation, and because they are such the greatest part of their energy is irretrievably lost.

Beam Transmitters

By concentrating the waves into a beam the recoverable energy is increased, but in the same degree the usefulness as a broadcast transmitter is decreased, for the area over which the waves may be intercepted is restricted.

It is this lack of power weakness that is also the main cause of static trouble. Atmospheric electricity will always be with us, and its nature is so closely allied to that of radio waves that it cannot be eliminated in any practical way so long as its intensity approaches and exceeds that of the impulses that are wanted. The only satisfactory solution to the problem seems to be in increasing the available power at the receiver.

The transmitter may be likened to a train announcer, who must send his voice across a noisy railroad terminal. The distinctness with which he can be heard in any part of the building depends solely upon the relative intensity of the voice waves and the noise waves at that particular point.

to take characteristics and characteristics of the transformer. If there was the energy available at the antenna that is now available at the output of the tube the amplifier could be eliminated, as well as the distortion that it produces.

One often reads in the press the announcement that some one at last has found means to send power by radio. If it were true the history of the world would be revolutionized. As facts stand, this has not as yet been practically accomplished. It seems to be the realization of the ordinary transmitter and very short distances, but the efficiency is so extremely small that commercial production of the phenomenon would be ridiculous.

Nikola Tesla was the first to try to solve the problem, and if anyone is ever achieved it will doubtless be by his system, too, which he has put on much more than twice. Professor Tilden, Lord Kelvin and a number of other contemporaries before the plan entirely feasible. If apparatus could be developed to generate and control the proper kind and intensity of electricity, Tesla has long since done this, and the system would only to await its application.

The system which we are not of radiation but of true conduction, utilizing the earth itself for the wire. That the earth is a conductor is demonstrated by the fact of its extensive use as a telegraph between wire and the ordinary radio ground connection. Tesla claims it to be a perfect conductor.

The average layman, and electrician as well, is so accustomed to using two wires to connect all his apparatus that he is likely to ask where the return wire is in Tesla's system. There is none, and for the reason that there must be none. By using alternating currents of proper frequency and correctly proportioning the circuit, loops may be set and currents run by means of a single wire with no return.

This is easily demonstrated with the common Tesla resonant transformer or Tesla coil. A bank of loops may be set or wires strung by attaching one terminal to the coil and the other to an insulated capacity, such as a metal plate of glass or plastic, which is filled and drained with the alternations of current.

A common capacity for Tesla's system is his radio transformer. For Tesla's system

The Radio Beginner's Series

Continued from page five

currents and drain a large B battery in no time. Even as it is, the UX-210 tube with 425 volts on the plate requires as normal operating voltage a grid battery of 55 volts to hold the plate current down to 22 milliamperes. This plate current is three or four times what the UX-210A takes on quarter the voltage without any B battery. The UX-210, even at 50 volts, has a normal operating grid voltage of 4.5 volts. The UX-120, a thru-hole tube, with only 135 volts on the plate, requires a normal operating grid voltage of 2.5V. To keep the UX-110 at 50 volts on the plate, the UX-110A at 50 volts on the grid. All tubes of

other tubes. The degree of brightness of the filament will regulate the resistance from plate to filament and also, if desired, the resistance be increased or decreased by use of a C battery or a potentiometer, as shown dotted, or the grid need not be connected at all. The coupling condenser should be large as in resistance coupling, upward from 5 mfd. to 7 mfd. being preferable, although as low as .01 will work well.

This is a novel way for the tube. The UX-110A, UX-210A, and UX-210A are the tube and wiring on the plate of the UX-110A.

CS

be no better, for there would be no way of honestly apportioning the collected money.

If there were but two or three manufacturers—and that is perfectly feasible if apparatus could be sufficiently developed so that it could be standardized—and four or five broadcasting stations for the entire country, the question of payment for broadcasting could be more satisfactorily met. Apparatus could be rented, like Bell telephones, or sold outright, like standard typewriters, and the user could at all times be sure of reliable maintenance service. The several broadcasters could afford to furnish the best of programs, for they would have a definite and continuous source of revenue.

Distance Wave May Travel

Doubtlessly, with transmitting and receiving apparatus which we have immediately at hand, this could be accomplished with possible success. But the equipment would be expensive and tremendously limited. Super-power would have to be used at the transmitter, and the sensitivity of the receiving sets increased with the increase in distance. As the distance which a Hertz wave transmitter may cover varies approximately with the square of the power used, it is obvious that the wattage would have to exceed that now in use manifold. Unless the wave lengths that were used were widely separated, receiving sets within the vicinity of these powerful transmitters would be interfered with beyond remedy.

In true radio transmission it would seem to the writer that a goodly portion of the transmitted energy should be recoverable. In our present system it is almost a total loss. One could realize this more fully if all receiving sets had only crystals. From the most powerful of modern transmitters scarcely ever can a crystal set receive satisfactorily over more than a hundred miles. If it had not been for the invention of the vacuum tube detector, oscillator and amplifier the entire system would have been long ago pronounced a failure, or at least relegated to a limited commercial and ship-to-ship code service.

currents and drain a large B battery in no time. Even as it is, the UX-210 tube with 125 volts on the plate requires as normal operating voltage a grid battery of 35 volts to hold the plate current down to 22 milliamperes. This plate current is three or four times what the UV-301A takes on quarter the voltage without any C battery. The UX-210, even at 90 volts, has a normal operating grid voltage of 4.5 volts. The UX-120, a three-volt tube, with only 185 volts on the plate, requires a normal operating grid voltage of 22½ to keep the plate current down to 6.5 milliamperes. The UX-112 at 90 volts on the plate requires six volts on the grid. All three of the new tubes are C battery tubes, while on the present tubes in use the C battery is a refinement and economy measure much advocated, but not used by any great percentage of set owners.

Reducing B Battery Current

Another way of securing amplification with a minimum of B battery drainage is the so-called "tone filter amplifier" in (1) of the figure. Here the coupling between the tubes is in the millions of ohms, variable leaks being used both for tube coupling and for grid leaks. Very low plate potential is used on the detector and, because of the tremendous resistance of the coupling, there is substantially no B bias on either of the next two tubes, but 90 volts on the last tube. The stopping condensers are .0005 mfd.

In place of either leaks, resistances, choke coils or transformers, the writer has frequently used and suggested coupling two tubes with a third tube, using the plate to filament resistance of the third tube as a coupling resistance, the diagram being shown at (2). Here we have a detector with one step of straight transformer-coupled audio. The "first" audio tube is coupled with the second audio tube through a tube placed between them as a resistor. This tube requires a separate A battery, as shown. It cannot be used with the same A battery as the

Continued from page five

other tubes. The degree of brightness of the filament will regulate the resistance from plate to filament and also, if desired, the resistance be increased or decreased by use of a C battery or a potentiometer, as shown dotted, or the grid need not be connected at all. The stopping condenser should be large as in resistance coupling, upward from .5 mfd. to 2 mfd. being preferable, although as low as .01 will work well.

This is a novel use for the tube. The 90 volts shown not only biases one grid of the resistance tube, but it passes through the tube and applies on the plate of the first audio tube. Of course, instead of 90 volts you can use up to 150 volts with benefit. Moreover, it is not essential to have a stage of transformer coupling precede this, and next week we will finally come around to the constant current amplifier, which is based on this simple tube resistance coupling with provisions for impressing a signal voltage on the resistance tube. At that time also we will reprint the diagram for a push-pull amplifier to complete the record.

Many times in the past we have printed the diagram for choke coil amplification. This is identical with the last two diagrams of last week's page, except that choke coils are used in place of resistance couplings. Many devices have been impressed into use as choke coils for this purpose. The secondary of an audio transformer, the primary of a bell ringing transformer, the Ford spark coil, various magnet windings, have all been used. Probably better than any of these is an audio transformer with primary and secondary connected in series aiding, making one coil of the two. You will have to reverse the connection between primary and secondary to be sure they are in the right order, but it makes no difference which coil is connected to B battery and which to plate. A blocking condenser and a leak must be used as in resistance coupling.

help to see where the return wire is in Tesla's system. There is none, and for the reason that there need be none. By using alternating currents of proper frequency and correctly proportioning the circuit, lamps may be lit and motors run by means of a single wire with no return.

This is easily demonstrable with the common Tesla resonant transformer or Tesla coil. A bank of lamps may be lit or wires moved by attaching one terminal to the coil and the other to an insulated capacity, such as a metal plate or sphere. The capacity serves as a sort of reservoir, which is filled and drained with the alterations of current.

Pumping System

In his radio transmitter Tesla mounts a huge capacity, having ideal enveloping surfaces that prevent radiation, on top of a tower and starts up an electrical pumping system, pumping electricity into and out of the earth. The pressure distributes itself over the entire globe, though it were a sphere of but modest dimensions, and by using receiving apparatus at different parts of the world, connected at one end to the earth and the other to a similar but smaller capacity, the energy can be recovered with small loss. Distance need not be reckoned with any more than it need be reckoned in a wire circuit with negligible resistance.

If Tesla's system works as well practically as it does theoretically its adaptation to broadcasting will go far toward relieving all those problems which were first suggested. It would permit of super-power transmission, with all of the good qualities and none of those that now put a limit to its effectiveness.

Notwithstanding the development of hundreds of new circuits, there has not been a single basic and radical improvement on our present radio system since De Forest invented the three-element vacuum tube. Props have been designed and both transmitting and receiving sets have been pushed to the limits of their capacity, but as for something really new it has yet to appear. The condition is a definite indication that the point of the flattening of the curve has been reached.

annual for the rainfalls an average height of 15,000 feet, and an annual precipitation of thirty-three inches, the twenty-four hour power per square mile is over 4,000, and for the whole area of the United States more than 15,000,000,000 horsepower. As a matter of fact the larger portion of the potential energy is used in air-friction. This, while disappointing to the economist, is a fortunate circumstance for otherwise the drops would reach the ground with a speed of 800 feet per second, sufficient to raise blisters on our bodies, while hail would be positively deadly. Most of the water which is available for power purposes comes from a height of about 2,000 feet and represents over one and one-half billion horsepower, but we are only able to use about a fall of say one hundred feet which means that if all the water power in this country were harnessed under the existing conditions only 80,000 horsepower could be obtained.

To Control Precipitation of Moisture.

BUT the time is very near when we shall have the precipitation of the moisture of the atmosphere under complete control and then it will be possible to draw unlimited quantities of water from the oceans, develop any desired amount of energy and completely transform the globe by irrigation and intensive farming. A greater achievement of Man through the medium of electricity can hardly be imagined.

The present limitations in the transmission of power to distance will be overcome in two ways; through the adoption of underground conductors insulated by power and through the introduction of the wireless art. The first plan I have advanced years ago. The underlying principle is to convey through a tubular conductor hydrogen at a very low temperature, freeze the surrounding material and thus secure a perfect insulation by indirect use of electric energy. In this manner the power derived from falls can be transmitted to distances of hundreds of miles with the highest economy and at a small cost. This insulation is sure to greatly extend the fields of electrical application. As to the wireless method we have energy in any desired amount and to distances only limited by the dimensions of this planet. In view of assertions of some misinformed experts to the effect that in the wireless system I have perfected the power of the transmitter is dissipated in all directions, I wish to be emphatic in my statement that such is not the case. The energy goes only to the place where it is needed and to no other.

When these advanced ideas are practically realized we shall get the full benefit of water-power and it will become our chief dependence in the supply of electricity for domestic, public and other uses in the arts of peace and war.

In the great departments of electric light and power immense opportunities are offered through the introduction of all kinds of novel devices which can be attached to the circuits at convenient hours for the purpose of equalizing the loads and increasing the revenues from the plants. I have myself knowledge of a number of new appliances of this kind. The most important among them is probably an electrical ice machine which obviates entirely the use of dangerous and otherwise objectionable chemicals. The new machine will also require absolutely no attention and will be extremely economical in operation, so that the refrigeration will be effected very cheaply and conveniently in every household. An interesting fountain, electrically operated, has been brought out which is likely to be extensively introduced and will afford an unusual and pleasing sight in squares, parks, hotels and residences. Cooling devices for all domestic purposes are being provided and there is great demand for practical designs and suggestions in this field. The same may be stated of electric signs and other attractive means of advertising which can be electrically operated. Some of the effects which it is possible to produce by electric currents are wonderful and lend themselves to exhibitions, and there is no doubt that much can be done in that direction. Theaters, public halls, and private dwellings are in need of a great many devices and instruments for convenience and offer ample opportunities to an ingenious and practical inventor.

A VAST and absolutely untouched field is the use of electricity for the propulsion of ships. The leading electrical company in this country has just equipped a large vessel with high speed turbines and electric motors and has achieved a signal success. Applications of this kind will multiply at a rapid rate for the advantages of the electrical drive are now patent to everybody. In this connection gyroscopic apparatus will probably play an important part as its general adoption on vessels is sure to come. Very little has yet been done in the introduction of the electrical drive in the various branches of industry and manufacture and the prospects are unlimited. Books have already been written on the agri-

cultural uses of electricity, but the fact is that hardly anything has been practically done. The beneficial effects of electricity of high tension have been undoubtedly established and a revolution will be brought about through the extensive adoption of agricultural electrical apparatus. The safeguarding of forests against fires, the destruction of microbes, insects and rodents will, in due course, be accomplished by electrical means.

In the near future we shall see a great many new uses of electricity aiming at safety, particularly of vessels at sea. We shall have electrical instruments for preventing collisions and we shall even be able to dispense fog by electric force and powerful and penetrative rays. I am almost without limit, will enable through aerial wires or cables, have reducing the necessary wiring to infinitesimal value. This invention, in connection with the necessity of erecting constructions which, however, are serious difficulties. It will also extend the wireless transmission of in all its departments.

The next art to be incorporated picture transmission by ordinary methods and existing apparatus. telegraphing or telephoning picture practical difficulties have numerous realizations. A number of improvements have been made and there is reason to expect that success will soon be achieved. Another valuable novelty will be writer electrically operated by the. This advance will fill a long felt want do away with the operator and save of labor and time in offices. A tremendously simple electric tachometer, pared for the market and it is a great it will prove useful in power plants stations, on boats, locomotives and.

Many municipal improvements use of electricity are about to be. We shall soon have everywhere suns, dust absorbers, combers, sterilizers, air, food and clothing, and accidents on streets, elevated roads and in will become next to impossible to con-

over one acre of ground will, on the average, develop only one horsepower. Thousands of mechanics and inventors have spent their best efforts in trying to perfect wave motors, not realizing that the power so obtained could never compare with that derived from other sources. The force of wind offers much better chances and is valuable in special instances but is by far inadequate. Moreover the tides, waves and winds furnish only periodic and often uncertain power and necessitate the employment of large and expensive storage plants. Of course there are other possibilities, but they are remote and we must depend on the first of three resources. If we use fuel to get our power we are living on our capital and exhausting it rapidly. This method is barbarous and wasteful and will have to be stopped in the interest of coming generations. The heat of the sun's rays represents an immense amount of energy vastly in excess of waterpower. The earth receives an equivalent of eighty-three foot pounds per second for each square foot on which the rays fall perpendicularly. These simple geometrical rules applying to a spherical body it follows, that the mean rate per square foot of the earth's surface is one quarter of that, or twenty and three-quarter-foot pounds. This is to say over one million horsepower per square mile, or 250 times the water-power for the same area. But that is only true in theory, the practical facts put this in a different aspect. For instance, considering the United States, and taking into account the mean latitude, the daily variation, the diurnal changes, the seasonal variation and casual changes this power of the sun's rays reduces to about one-tenth, or one hundred thousand horsepower per square mile, of which we might be able to recover in high speed low pressure turbines ten thousand horsepower. To do this would mean the installment of apparatus and storage plants so large and expensive that such a project is beyond the pale of the practical. The inevitable conclusion is that water-power is by far our most valuable resource. On this humanity must build its hopes for the future. With its full development and a perfect system of wireless transmission of the energy to any distance man will be able to solve all the problems of material existence. Distance, which is the chief impediment to human progress, will be completely annihilated in thought, word and action. Humanity will be united, wars will be made impossible and peace will

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Telegraphic Photograph.

GREAT improvements are being made in telegraphy and telephoning. The receiving device which will be able to receive the faintest signals, and the sensitivity of which can be almost without limit, will enable through aerial wires or cables, have reducing the necessary wiring to infinitesimal value. This invention, in connection with the necessity of erecting constructions which, however, are serious difficulties. It will also extend the wireless transmission of in all its departments.

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LETTERS TO THE EDITOR
TESLA ON WIRELESS.

Electrical Inventor Thinks Marconi's Plants Inefficient.

To the Editor of The Tribune.

to the Editor of The Tribune.

It is a great honor and a great privilege to be concerned there is a real difference between the great inventor Thomas A. Edison and myself, integrity in my favor. Mr. Edison knew little of the life I have, in this special field, probably more experience than any of my contemporaries. That you are not as yet able to impart your wisdom by wise counsel to some of the great minds of the world, in their temple, and that the pressures of your valuable paper are not operated by wireless power, largely due to your own effort to make the life of your countrymen and the people of this city, and of your fellow citizens, to be the best. I have received from my celebrated colleagues, Thomas A. Edison and Michael I. Pupin, assistant conductors of the wireless telegraph all welcome to me. Difficulty develops treasure.

developed recently across the Atlantic was not made by any device of Mr. Marconi's, but by my system of wireless transmission of energy. I have already given notice by cable to my friend Sir James Watson of the royal institution of the fact that I shall also request some eminent man of science to take careful note of the whole apparatus, its mode of operation, dimensions, and electrical and mechanical characteristics, and to report on the same, possible its exact reproduction and a repetition of the experiments. This request is entirely impersonal. I am a clinician, not a statesman, and I know that the thing I am doing is my duty, and that I am absorbed in commerce, and I am unable to think of posterity, will honor my country, and I am sure that the world will honor me. A measurement of the time of the light taken in the passage of the signal will allow to the full and positive determination of the distance between the ocean with a mean speed of 186,000 miles a second.

The barefaced plants are inefficient, and do not lend themselves to the practice of two discoveries of mine, the "art of individualization," that makes the message non-interfering and non-interferable, and the "stationary waves," which make the earth equivalent absolutely and make the whole earth equivalent to a conductor devoid of resistance. Were it not for this deficiency, the number of words a minute could be increased at will by "individualizing."

You have already commented upon this advantage in terms which have caused me no small astonishment, in view of your normal attitude. The underlying principle is to combine the effects of vibrations, preferably slightly different in frequency, to interfere, and thus to maintain the operation of the receiver dependent on the co-operative effect of a number of attuned elements. Just to illustrate what can be done, suppose that only four vibrations were superimposed on each transmission. Let these be designated respectively as *a*, *b*, *c* and *d*. The following individualizing combinations would be possible: *a*, *b*, *c*, *d*, *ab*, *ac*, *ad*, *bc*, *bd*, *cd*, *abd*, *acd*, *abc*, *abd*, *acd*. The same attitude can be extended to five, six, seven, eight, nine, ten, and, with great care, to twenty-two lines, which can be

simultaneously operated. To transmit one thousand words a minute, only forty-six words on each combination are necessary. If the plants were suitable, not ten years, as Edison thinks, but ten hours would be necessary to put this improvement into practice. To do this, Marconi will have to reconstruct the plants, and it will then be observed that the indefatigable Italian has departed from universal engineering customs for the fourth time.

New York, Oct. 24, 1907. NIKOLA TESLA.

A TIME FOR SANITY.

A TIME FOR SANITY.

Restoration of Confidence the Imperative Need.

To the Editor of The Tribune.
 Sir: Your columns are always open to whatever seems to concern the public good. Will you let me say a few words, if you please? In lower New York this is the time for many people to show their

FOR FOUNTAIN DESIGN. SPOT

*S. P. C. A. Prize Goes to H. Van
Buren Magonigle, Architect.*

As the result of a competition designs by H. Van Buren Magonigle, the architect, for simple, serviceable drinking fountains for men, horses and dogs received the prize from the American Society for the Prevention of Cruelty to Animals and was subsequently approved by the Municipal Art Commission. Permission was granted by the commis-

FOUNTAIN ERECTED YESTERDAY AT
BRYANT PARK.

Fortieth street and Sixth avenue, by the American Society for the Prevention of Cruelty to Animals.

slon to have replicas erected at certain selected suitable points in the city already approved of by the Board of Aldermen.

The society yesterday, at a cost of about \$20, erected one of the fountains at Bryant Park, 270 street, just east of Sixth avenue. On one side of the bronze fountain, facing the street, is the horse bowl, and on the opposite side are the man and dog bowls.

The society has just erected a fountain of similar design in the Williamsburg plaza. It will be in operation next week. Another one of these fountains will soon be erected by the society at 7th street, Broadway and Amsterdam avenue. It has been paid for by Mrs. E. J. Post, of the Spencer Arms, and will bear the inscription:

The society will soon place a fountain, designed by John S. Humphreys, at Fifth street and Broadway, the gift of F. Augustus Schenck, and another in Fourth avenue, in the rear of Gray Church, which will be the contribution of a parishioner.

Fountains designed by William Singer will be erected at Coentia Slip, the gift of Frank K. St. Clair; at Rutgers Slip, the gift of an anonymous woman contributor, and in Battery Place, the gift of F. Augustus Schermerhorn.

KAISER'S GIFT RECEIVED.

*Busts Presented to the United States
Military Academy.*

West Point, N. Y., Oct. 21.—All academic duty was suspended this afternoon in honor of the presentation to the academy by Emperor William of Germany of the busts of Frederick the

Great and General Field Marshal Count von Moltke. The ceremonies took place in the main reading room of the library, the entire community

[illegible]

FOUR'S CLOSEST FRIEND A DUKE.

should have been despoiled of the Château d'Argord and of so much of his wealth by the Duke of Périgord, family his most intimate friend and associate should be the Marquis de Talleyrand-Périgord, Duc de Dinc, who enjoys the noble distinction of having married twice, first a woman in turn and of having been married to each of them. One of these women still continues to use the title of Marquise de Talleyrand-Périgord, her husband being a narcissist devoted to his father's dukedom. His daughter, assumed, in accordance with the custom of the present day, her maiden name, is now known as Mrs. Adele Sampson.

the Duo de Dino and of the Marquis de Bouchet are similar in many respects and both quite the reverse of domestic, though all of them in spite of their lineage and patrician mannerisms and prejudices radiate in politics to the extent of socialism, and each possesses a most extraordinary knowledge and experience in everything relating to art and literature. Many of the art treasures of the country have found their way to this country at one time or another, and may be seen in private collections.

another, and may be seen at the Metropolitan Museum of Art in New York. Like most of the dukes helped Louise Michel, and during the great strike took place at and upon the scene with pecuniary assistance. The duke possesses a number of old pen, has written a number of books, including a fairly volume of verse "Adieu à Vous" and dedicated to his

after the battle of Champligny in the war of 1870, and it is greatly to his credit that his name was put forward for the decoration of the Legion of Honor. This honor was given to him on the ground that he had the misfortune to be killed. His brother, Count Archibald de Talleyrand, was serving as a captain in the French army, and he was killed in the German army. Despite his actual death, he was given the rank of a colonel. He was the son of a Duke, who preferred to be called a Duke of Talleyrand. He had his house always filled with the most beautiful of his rank. In the Henry II time, he was given the armorial bearings are embroidered on his armor, carved on the sideboards, painted on the walls, and on the porcelain made for him. He was given the armorial bearings as well as engraved on his armor.

THIEN MARQUETTE DE ROCHEFORT
 or Rochefort, he, like his friend, the Duc
 had some rather odd matrimonial ex-
 perience. He has been thrice married. His first
 wife was Miss. Renaud, the mother of his two
 sons. He was under sentence of death in prison
 for the suppression of the Commune, and, hearing
 of his lay dying, in spite of all his protest-
 ings, notwithstanding his religious belief, asked for
 a priest to administer to him, to be brought to his last
 moments.

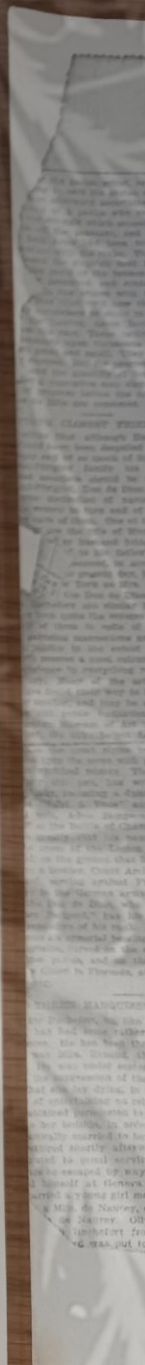
her bedside, in order that he might be ec-
clesiastically married to her in the hospital, where
he died shortly afterward. His sentence was
sent to penal servitude in New Caledonia
and he escaped by way of America. He called
himself at Geneva in Switzerland. There
he married a young girl more than thirty years his
junior, Mlle. de Nauvay, daughter of the widow
de Nauvay, Olivier Pain, who had es-
caped from New Caledonia, and
who was put to death by the Maudslayi.

...a time when it is
very image formed in thought
under it visible at any place
of the means of sending
a revolution for the better in
the. Unfortunately, it is true,
where, all need, themselves
to further their relations

...and an annual precipitation of thirty-
es, the twenty-four hour power per
he is over 4,000, and for the whole area
nited States more than 12,000,000,000
As a matter of fact the larger por-

...hardly anything has been practically done. The
beneficial effects of electricity of high-tension
have been unmistakably established and a revolu-
tion will be brought about through the extensive
adoption of agricultural electrical apparatus. The

...in a time not distant it will be possible
to flash any image formed in thought on a screen
and render it visible at any place desired. The
perfection of this means of sending thought will
create a revolution for the better in all our social
relations. Unfortunately, it is true, that sending





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C 3



NEW INVENTION BY
M. NIKOLA TESLA.

He Discovers that He Has Found a
Perfect Electric Insulator.

New York, Friday. The latest startling announcement of the ingenious Nikola Tesla, known to have discovered a perfect insulating material, is that he has found a perfect insulating material. He said to me today when I called on him at his Waldorf-Astoria, that the idea was suggested to him by Professor Dewar, of the Royal Institute, in 1894. He had been working on it ever since, and had just obtained a patent.

The process is a chemical process to freeze and distill water and sodium in a thin metal tube about the wire carrying the electric current. Mr. Tesla declares that electricity will in this way be transmitted from Niagara Falls to the Pacific Coast or through the ocean from New York to London, with no perceptible loss of power. He asserts that the invention will greatly cheapen electricity and cause a revolution in industrial affairs.—Daily Mail.

THE
NEW
INVENTION
BY
NIKOLA TESLA.

How it can be used at Niagara
by the New York State
Electric and Light Co.

NO PLANT IS NECESSARY.

Insulators. The author has been
able to find out the best
method of using the same.

It is the best of all the others.

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NEW INVENTION BY
M. NIKOLA TESLA.

He Declares that He Has Found a
Perfect Electric Insulator.

New York, Friday.—The latest startling announcement of the inventor Nikola Tesla is that he has discovered a perfect insulation for electricity. He said to me to-day, when I called on him at the Waldorf-Astoria, that the idea was suggested to him by Professor Dewar, of the Royal Institute, in 1893. He had been working on it ever since, and had just obtained a patent.

The plan is by a chemical process to freeze a mixture of water and sawdust in a thin metal tube about the wire carrying the electric current. Mr. Tesla declares that electricity will in this way be transmitted from Niagara Falls to the Pacific Coast, or through the ocean from New York to London, with no perceptible loss of power. He asserts that the invention will greatly cheapen electricity, and cause a revolution in industrial affairs.—Daily Mail.

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News.—The latest start-
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the idea was suggested
for the use of the Royal
Academy. He had been working
on it for some time and had just obtained a

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the water and hardest in
the air. Mr. Tesla declares
that this may be trans-
ferred to the Pacific
Ocean from New
York. He has no terrible loss
of time. The invention
is electric, and causes
industrial affairs.—Daily

THE NIGHT SHOOTING MACHINE

Photos Taken at Midnight
by His New Vacuum Tube
Perfect as at Noon.

NO FLASH IS NECESSARY.

Inconveniences to Sitter Are Ban-
ished and Pictures Are Won-
derfully Vivid.

USEFUL IN LIGHTHOUSES.

The new vacuum tube machine has
been used by the United States Navy
for the purpose of taking pictures of
the sea at night. It is a small machine
which can be used in a lighthouse or
on a ship. It is a very simple machine
and can be used by anyone. It is a
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Jahrgang 1895.



Sohn der Sonne.

Nicola Tesla, Edison's
großer Rivale.

„Macht Sonnenlicht.“

Ein Besuch in seinem Labora-
torium.

Elektrizität der Zukunft.

„Mutter, gib mir die Sonne.“
(Edison's „Gespinnst“.)

In den frühen Morgenstunden des 1. März vorbereitete sich die Kunde von dem Brande des Tesla'schen Laboratoriums in New York. In der Nähe der Brandstätte, vor dem Hause No. 33 und 35 South 5. Ave., standen zwei alte Menschen und diskutierten die Ereignisse, als sich plötzlich ein junger Mann von etwa 35 Jahren unter allen Zeichen der fürchterlichsten Verwirrung einen Weg durch die Menge bahnte, um beim Anblick der rauchenden Trümmer fast zusammen-

zu brechen. Der große Unger ist ein tüchtiger, hochbegabter Ingenieur. Hier befindet sich das Reich Nicola Tesla's. Die Schwierigkeiten auf Ellis Island gegen die Schwierigkeiten entgegenstellen, der großen Erfinders hat sein Laboratorium — wie ein alter Bart's Geheimnis — verschlossen. Wir aber sind keine gewöhnlichen Sterblichen, wir kennen die Geheimnisse und dürfen eintreten.

Eine weite, hohe Halle stellt sich vor uns aus, durch die ein eigenwilliges, hellgelbes Licht den Schein, der sich in den schiefen auf riesige Pfeiler stützt, deren Glieder sich wie riesige Gespensterrinnen hoch über den Köpfen der endlosen Experimentierenden der Physik, der Chemie, der Physiologie mit allen ihren Nebenprodukten vor unsern Augen durcheinander. Ein scharfer Quengeruch durchflutet den Raum.

Wir wissen, die gewöhnlichen Maschinen sind zweifellos elektrische Maschinen, die hohen, mit Metall belegten Glasgefäße, aus denen sich die metallenen Stangen mit den glänzenden Augenspitzen ragen, sind in denen Flaschen — in ihrer Anordnung eine regelrechte Lebensgefäß — in der Luft unbeeinträchtigt stehen. Da steht ein ungeheures, wie ein riesiges Gefäß, in das, wie ein riesiges Gefäß, aus verschiedenen Zellen, die mit Draht und einer Spule versehen sind. Schräg nach diesem Gefäß hängt eine große, röhrenförmige Zylinder, über der sich eine Vorrichtung zu verbergen scheint. In deren Ausläufer wie einen trichterförmigen Kessel zu sehen glauben. Und rätselhafter, wie diese Gegenstände erscheinen und noch mehrere in den Ecken der Halle aufgestellte große, röhrenförmige Metallballons, deren Silberblech glänzende Strahlen ausstrahlt, welche Abends das den Raum durchflutende magische Licht noch verstärken. Es ist eine veritable Wunderwelt. Wer wäre da nicht neugierig nach dem Leben und Treiben, dem Wesen und Wollen des Mannes, der hier haust und wie ein moderner Alchimist — mit dem ganzen, genialen Willen der Wissenschaft experimentiert.

Nicola Tesla wurde vor 37 Jahren in Smiljan, einem serbischen Dorf von etwa 40 Häusern, geboren. Er ist 6 Fuß hoch, seine Gesichtszüge zeigen auffallend den slavischen Typus, nur

die untereinander verbunden und mit dem elektrischen Strom in Verbindung gebracht sind; ein elektrisches Wesen, mehr, das schlafet, lebt, den Raum durchflutet er eine (Geister) Materie, die er selbst leuchtet, und in jeder Hinsicht ist ihm blaues Haar herab blühende blaue Haare, aus jeder Fingerspitze, von jedem er sieht aus wie der lebhafteste Charakter. Einer, dem dies Experiment unheimlich imponiert hat, ist Prinz Heinrich von Preußen, der es gelegentlich einer Vorlesung in der „Armenia“ in Berlin selbst an sich probiert.

Der eine Erklärung dieses Experimente denials, der wird von Tesla zunächst mit Zahlen regaliert, die einen Durchschnittsmenschen gar zu sammeln müßten.

Man nehme eine 5 und hänge einen Nerven an, das Resultat wird eine Zahl sein, die folgendem ausreicht 500,000,000,000,000. Diese Zahl stellt nach Tesla die Anzahl der Schwingungen im Aether per Sekunde dar; Alles, was er zu thun hat, um Sonnenlicht auf der Erde zu erzeugen, ist, die gleiche Anzahl Schwingungen in der Sekunde hier zu erzeugen. Das ist das ganze Rezept, ungeheuer einfach, nicht?

Tesla hat indessen noch andere Pläne. Er will ohne Leitung durch die Erde telegraphieren. Vorher muß er nur noch messen, wieviel Schwingungen per Sekunde durch Ableitung der in der Erde enthaltenen Elektrizität entstehen, um hier die gleiche Anzahl Wellen zu erzeugen.

Nicola Tesla war es, der vor einer großen Versammlung in Philadelphia eine Viertel Millionen Volten durch seinen Körper leiten ließ. Damals rief er voll Stolz aus: „Man gebe mir eine Million Volten und ich schaffe eine Sonne.“

Seiner griechische Jüngling — Phäeton, glaube ich, hieß er — welcher bekanntlich auch Sonnenlicht erzeugen wollte, stürzte bei seinem Versuche die Erde in Brand und wurde dafür von Zeus mit dem Blitz erschlagen. Ein Sonnensohn des 19. Jahrhunderts fürchtet keinen Blitz mehr. Er giebt ihm, wie der Sonne. Eine Viertel Million Volten! Zur Hinterrichtung der Mörder in Sing Sing genügen nicht ganz 2000 Volten.

Elektrizität der Zukunft.

Nicola Tesla über seine Projekte spricht, wie er hochinteressant. Ein Wort kann man verstehen. Er stellt die Zeit in Billonstel einer Sekunde, spricht von überhaupt nicht wahrnehmbaren Kräften, die groß genug sind, um sämtliche Arbeit in den Vereinigten Staaten zu thun, und kommt endlich zu dem Schluss, daß die soziale Frage durch Elektrizität gelöst werden wird.

Tesla ist stolz auf seine slavische Abstammung. Er glaubt, daß die Schwingungen slavischer, speziell serbischer und kroatischer Dichter die Welt im Erhabenen leben würden, wenn sie in eine guten Übersetzung bekannt würden.

Er ist ein großer Verehrer der Herren der Tafel. Er erklärt, er verpüre die kräftigste Wirkung einer guten Mahlzeit schon 20 Minuten nach dem

der untereinander verbunden und mit dem elektrischen Strom in Verbindung gebracht sind; ein elektrisches Wesen, mehr, das schlafet, lebt, den Raum durchflutet er eine (Geister) Materie, die er selbst leuchtet, und in jeder Hinsicht ist ihm blaues Haar herab blühende blaue Haare, aus jeder Fingerspitze, von jedem er sieht aus wie der lebhafteste Charakter. Einer, dem dies Experiment unheimlich imponiert hat, ist Prinz Heinrich von Preußen, der es gelegentlich einer Vorlesung in der „Armenia“ in Berlin selbst an sich probiert.

Tesla hat indessen noch andere Pläne. Er will ohne Leitung durch die Erde telegraphieren. Vorher muß er nur noch messen, wieviel Schwingungen per Sekunde durch Ableitung der in der Erde enthaltenen Elektrizität entstehen, um hier die gleiche Anzahl Wellen zu erzeugen.

Nicola Tesla war es, der vor einer großen Versammlung in Philadelphia eine Viertel Millionen Volten durch seinen Körper leiten ließ. Damals rief er voll Stolz aus: „Man gebe mir eine Million Volten und ich schaffe eine Sonne.“

Seiner griechische Jüngling — Phäeton, glaube ich, hieß er — welcher bekanntlich auch Sonnenlicht erzeugen wollte, stürzte bei seinem Versuche die Erde in Brand und wurde dafür von Zeus mit dem Blitz erschlagen. Ein Sonnensohn des 19. Jahrhunderts fürchtet keinen Blitz mehr. Er giebt ihm, wie der Sonne. Eine Viertel Million Volten! Zur Hinterrichtung der Mörder in Sing Sing genügen nicht ganz 2000 Volten.